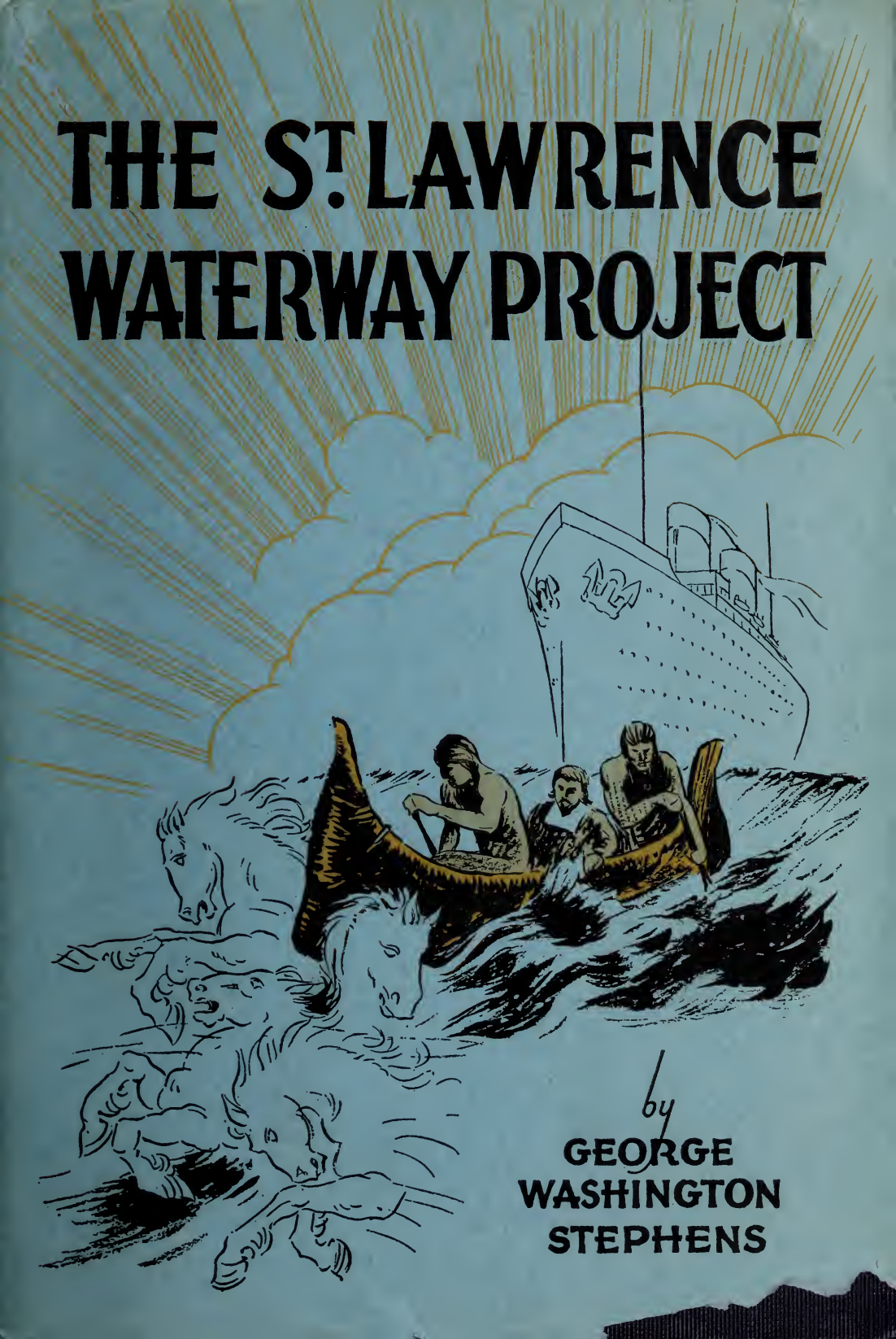
THE St. LAWRENCE WATERWAY PROJECT



by

GEORGE WASHINGTON STEPHENS

JOINING GREAT LAKES
AND OCEAN

ALMOST every business man in the United States and Canada will be concerned to some degree if the development of the St. Lawrence River as a deep waterway to the Atlantic is realized. Mr. Stephens's all-embracing work, therefore, should be in the office of every American and Canadian business man. It is a complete summary of the history of the Waterway scheme. It sets down every argument of those who favor the development, and the reasons of others who are objecting to the project. It includes documents, tables, statistics, and facts obtained from every conceivable source. It is unbiased, exhaustive, comprehensive.

The importance of development on a large scale of the St. Lawrence Waterway has stirred leaders in the worlds of politics and commerce both in the United States and Canada for some years, until it is looming large on the immediate horizon.

Diversified interests have naturally entertained divergent contentions, while a complete exposition, outlining the entire scheme, has been lacking. Mr. Stephens, late president of the Saar Valley Governing Commission, has filled this public need.

Illustrated with many maps, drawings, and valuable photographs.

THE ST. LAWRENCE
WATERWAY PROJECT
by
George Washington Stephens

Price $6.00

LOUIS CARRIER & CO
Montreal, London, New York

Digitized by the Internet Archive
in 2014

https://archive.org/details/stlawrencewater00step

AMERICA
SEPTENTRIO-
NALIS
CIRCULUS
New Northwales
Buttons
Bay
A M E R
SEPTENTRION
NUEVA
GRANADA
NUEVA BISCAYA
GOLFO DE
MEXICO
M A R D E L
Z U R
1627
AMSTELODAMI,
Excudit Ioannes Ianßonius
LINEA ÆQU
230
240
250
260
270
280
290
50
40
30
20
10

ARCTICUS
FRETUM HUDSON
FRETUM DAVIS
META IN COGNITA
OCEANUS DEUCALE DONJUS
NOVA BRITANNIA
NOVA Canada
Golphe de S. Louis
Terra
Golphe de
Novelle Biscaie
FRANCIA
Acadia
NOVUM BELGIUM
VIRGINIA
MARE VIRGINIUM
MAR DEL NORT
TROPICUS CANCRI
SANTA MARTHA
PARIA
MERIDIONALIS PARS
Parime lacus
300
310
320
330
340
350
50
40
30
20
10

The St. Lawrence Waterway Project

"To those who see only with their eyes, the distant is always indistinct and little, . . . but to the imagination, . . . the far off is great and imposing," . . . Mrs. Jameson.—*Studies, Detached Thoughts.*

A section of the harbor of Montreal from the air

Courtesy Department of Immigration and Colonization, Canadian Pacific Railway

The
St. Lawrence Waterway Project

The Story of the St. Lawrence River
as an International Highway for Water-borne Commerce

BY

George Washington Stephens

Member of the International Academy of Diplomacy
Late President of the Saar Valley Governing Commission
Late President of the Montreal Harbor Commission

LOUIS CARRIER & CO
MONTREAL - LONDON - NEW YORK

Copyright, Canada, 1930
by Louis Carrier & Co., Ltd.

All rights reserved

First Impression, December 1929
Second Impression, December 1929
Third Impression, December 1929

Wrapper design adapted by Pierre Saint-Loup from a drawing
furnished by Nesbitt, Thomson & Company, Limited

Printed in Canada at Toronto in the Province
of Ontario by Warwick Bros. & Rutter, Ltd.

CONTENTS

PAGE

FOREWORD 13

Chapter I TREATIES, BOUNDARIES, WATERWAYS, 1713-1929 . . . . . .

Treaty of Utrecht, 1713—Treaty of Paris, 1763—Treaty of Peace, 1783—Treaty of Amity, Commerce and Navigation, 1794—Treaty of Ghent, 1814—Ashburton-Webster Treaty, 1842—Oregon Boundary Treaty, 1846—Treaty of Reciprocity, 1854—Treaty of Washington, 1871—International Boundary Demarcation Treaty, 1908—Boundary Waters Treaty, 1909—Boundary Treaty, Passamaquoddy Bay, 1910—Boundary Demarcation Treaty, 1925—Niagara Falls Convention, 1929. . 17

Chapter II TRANSPORTATION AND COMMUNICATION .

Early railway construction in Canada—Grand Trunk Railway—Canadian Pacific Railway Syndicate & Company—Canadian Northern Railway—Grand Trunk Pacific Railway—Royal Commission of 1916—Canadian National Railways—Development of Canadian Railways, 1840-1927—Water transportation in Canada—Shipping and shipbuilding—Railway construction in U.S.—Development of U.S. railways, 1830-1917—Shipping and shipbuilding in U.S.—Transportation in Great Lakes tributary area—Characteristics of Canadian and U.S. tributary areas. 51

Chapter III INTERNATIONAL ASPECT OF ARTERIAL WATERWAYS . . . . . .

Waterways in the early ages—Position prior to Congress of Vienna, 1815—Congress of Vienna to present time. . . 85

Chapter IV ST. LAWRENCE WATERWAY PROJECT . .

The St. Lawrence River—Comparative distances to Liverpool—The St. Lawrence project—The Great Lakes—International Joint Commission's recommendations—Joint Engineering Board's recommendations—Power installations—Detailed plans and costs—General summary—St. Lawrence Ship Channel and comparison with other ship channels. 95

PAGE

Chapter V HISTORY OF THE NEGOTIATIONS OF THE ST. LAWRENCE WATERWAY PROJECT, 1832-1929 . . . . . .

First Period, 1832-1920.—The project of 1832—International Waterways Commission—International Joint Commission—Request from U.S. that question of deepening St. Lawrence be referred to International Joint Commission—Canadian Deep Waterways and Power Association formed—International Joint Commission's investigation. 147

Second Period, 1921-1922.—Schemes submitted to International Joint Commission—International Joint Commission's report—U.S. invites Canada to negotiate treaty—Public organizations for and against project. 180

Third Period, 1923-1927.—Joint Engineering Board appointed—U.S. St. Lawrence Commission appointed—Canadian National Advisory Committee appointed—Joint Engineering Board's report—U.S. St. Lawrence Commission's report—U.S. again invites Canada to negotiate treaty. 205

Fourth Period, January, 1928, *to March* 1929.—Canadian Government's attitude to project defined—Canadian National Advisory Committee's report—Canada and U.S. exchange diplomatic notes—Parliamentary debates—Order in Council submitting questions of Dominion and provincial rights to Supreme Court of Canada—Supreme Court's judgment. . 225

Chapter VI CANALS OF CANADA AND THE UNITED STATES

(a) The Canals of Canada

Early history—St. Lawrence River canals—Lachine Canal—Beauharnois or Soulanges Canal—Cornwall Canal—Williamsburg Canals—Welland Canal—Prescott terminal—Kingston terminal—Welland Canal compared with other ship canals—Sault Ste. Marie Canal—St. Anne Lock—Carillon and Grenville Canals—Rideau Canal—St. Ours Lock and Dam—Chambly Canal—Murray Canal—Trent Canal. . . . 251

(b) United States Canals Connecting International Boundary Waters.

Early history—Sault Ste. Marie Canal—Traffic exceeds that of Panama, Suez, Kiel and Manchester combined—New York State Barge Canal—New York supersedes Philadelphia as commercial emporium—Sturgeon Bay and Lake Michigan Ship Canal—St. Clair Flats Canal—Black Rock Channel—Keweenaw Waterway. 287

CONTENTS

PAGE

Chapter VII THE CHICAGO SANITARY AND SHIP CANAL (CHICAGO DIVERSION) . . . .

Cost—Reason for building—Dimensions—Lakes-to-the-Gulf-Deep-Waterway—Future profit—History of Chicago Diversion—Injunction in Federal Court—Opinion rendered by Judge Landis, 1920—Opinion rendered by Judge Carpenter, 1923—Decision of U.S. Supreme Court, 1925—Further permit issued to expire 1929—Chicago's remedy for present diversion—Present position in Supreme Court—Report of C. E. Hughes, 1927, concerning effects of diversion—Table showing amounts by which diversion lowers water levels—Correspondence between the two Governments—Expenditure by Chicago on measures for improving situation—Memorial presented to President Hoover from lake states not to approve further plan for development of Lakes-to-the-Gulf-Deep-Waterway that would contravene decision of Supreme Court. . . 309

Chapter VIII ALTERNATIVE WATER ROUTES TO EUROPE .

Hudson Bay Railway—Erie Canal route—Lakes-to-the-Gulf-Deep-Waterway—Illinois and Michigan Canal—Illinois and Mississippi Canal—Vancouver—Panama route—Georgian Bay Canal and "All-American" Ship Canal projects—Summary. 321

Chapter IX POWER . . . . . .

World power—Power in the United States—Power in Canada—Ontario power—Ontario Hydro-Electric Power Commission—Quebec power—Beauharnois project, 1929. . . 333

Chapter X REFLECTIONS . . . . . .

Introduction — Preliminary adjustments—Navigation—Power Transportation—Cost—Conclusions. 355

APPENDICES

PAGE

Appendix I 396

Convention between Canada and the U.S., 1929, regarding Preservation of Scenic Beauty of Niagara. (Chapter I)

Appendix II 399

General analysis of costs. (Chapter IV)

Appendix III 402

Information regarding work of deepening channel of St. Lawrence between Montreal and Quebec to 35 feet. (Chapter IV)

Appendix IV 404

Findings of Supreme Court as to Relative Merits of Dominion and Provinces in relation to Proprietary Interest in and Legislative Control over Waters with respect to Navigation and Water-powers created or made available or in connection with Works for Improvement of Navigation. (Chapter V)

Appendix V 416

Outline chart of Arguments advanced for and against St. Lawrence project.

ACKNOWLEDGMENTS 417

BIBLIOGRAPHY 421

INDEX OF NAMES 429

SUBJECT INDEX 435

ILLUSTRATIONS

PAGE

A section of the harbor of Montreal from the air ..*Frontispiece*

A section of the water front at Detroit 78

Port Dalhousie, showing ship congestion at head of old Welland Canal (October, 1928) 94

Giant lock, new Welland Ship Canal 110

S.S. *Duchess of Atholl* passing under Quebec Bridge . . 126

Power development at Paugan Falls on the Gatineau River, Province of Quebec 190

A section of the water front at Toronto 222

S.S. *Rapids King* shooting Lachine Rapids . . . 254

Lift bridge over new Welland Ship Canal (open) . . 286

Sault Ste. Marie locks from the air, showing American locks (left) and Canadian lock (right), between Lake Superior and Lake Huron 318

Aerial view of Shawinigan Falls 350

Typical lock gates, new Welland Ship Canal . . . 372

MAPS

PAGE

America from the Arctic Circle to South America—*Endleaves*

Faden's Map, 1783 . . . . . 24A

Mitchell's Map, 1755 . . . . . 24B

St. Lawrence Waterway 166

Detailed Map of St. Lawrence from Montreal to Lake Ontario 388

St. Lawrence and Alternative Water Routes to Europe 326

Old and New Beauharnois Canals 350A

TO MY WIFE

"HEART ON HER LIPS, AND SOUL WITHIN HER EYES
SOFT AS HER CLIME, AND SUNNY AS HER SKIES."

I
DEDICATE THIS ATTEMPT TO DISENTANGLE
THE FACTS AND FALSEHOODS
OF A GREAT
INTERNATIONAL PROBLEM

FOREWORD

HAVING been long away from my homeland, I find on my return that the St. Lawrence Waterway project is one of the problems that is soon to occupy the attention of the Canadian people. About the subject itself there exists a considerable dearth of knowledge. Apart from a few authoritative opinions expressed by students of the problem, such comment as I have heard has been mostly prejudiced by sentiment or biassed by self-interest.

The St. Lawrence Waterway, considered as an international highway of commerce penetrating the heart of a continent, consists of 2,200 miles of navigable water extending from the head of the Great Lakes to the Atlantic Ocean. As a wholly Canadian trade route it comprises roughly a stretch of 1,000 miles which is open to ocean-going vessels from the Atlantic seaboard to Montreal.

The St. Lawrence Waterway project is a scheme for the deepening of that portion of the river that lies to the west of Montreal and extends as far as Kingston, so that vessels drawing not more than 25 feet of water may reach the inland harbors of the Great Lakes. The project also includes the simultaneous development of the water power resources contiguous to the proposed deepened channel and the construction of suitable lake harbors and terminals.

The undertaking is one of the most momentous and far-reaching that has come before the people of the Dominion since Great Britain and the United States concluded the Treaty of Washington in 1871. Under this treaty the United States received free navigation rights in the Canadian part of the St. Lawrence River in perpetuity.

Geographically, a line passing through the middle of Lakes Superior, Huron, Erie and Ontario, thence down the middle of the River St. Lawrence to Cornwall on the north side and St. Regis on the south, a distance of 1,144 miles, forms part of the international boundary between Canada and the United States. From here to the Atlantic Ocean, a stretch of 1,074 miles, the river is wholly Canadian, developed entirely by Canadian initiative, skill, energy and money.

Canals have been constructed and are in operation on Canadian territory providing a depth of 14 feet of water. These are used where rapids and shoals prevent river navigation, thus enabling vessels of this draft to proceed inland as far as Chicago, Duluth, Fort William and Port Arthur. Canal and river channels between the Great Lakes have been deepened to afford 20 foot navigation from Lake Ontario westward.

Throughout the whole length of its course from where the 45th parallel strikes the St. Lawrence at St. Regis to the Atlantic Ocean the rights of navigation in the river, under the Washington Treaty of 1871, are shared on equal terms by two great neighbors, Canada and the United States. The waterway, therefore, is international in character.

The St. Lawrence River is one of the world's great trade routes. It is destined to be, on an ever-increasing scale, a carrier of world commerce between the North American continent and the rest of the world. It nurses in its bosom a vast

amount of sleeping electrical energy the development of which is likely to be a prominent factor in the industrial and economic expansion of both Canada and the United States.

Since the St. Lawrence Waterway project is one of the first magnitude, upon which every Canadian citizen should be informed, it has seemed worth while to assemble the main facts concerning the question so that a view may be obtained of its bearing upon Canada's economic and commercial future, her trade relations with the countries of the world, and in particular, her relationship with her neighbor, the United States.

The main object of this book, therefore, is to place essential and authoritative information within reach of Canadians and citizens of the United States, whose interests are mutually involved. An attempt has been made to do this in an impartial spirit. The vast range of the problems involved, and the far-reaching consequences of the decisions to be taken, make it important that public opinion should be well informed. In this book I have given the result of months of research and study, with no pretension of having exhausted the subject, but in the hope that the information here presented may be useful. In the last chapter I have taken the liberty of putting forward thoughts of my own suggested by a review of the questions presented in these pages.

In acknowledgment of the assistance received during the pursuit of this investigation, I tender thanks to George Marshall of Montreal, whose enthusiasm and expert help as amanuensis in securing desired information, were a source of inspiration throughout the period of inception. On his shoulders fell much of the work of investigation and research, into which went unusual care and patience.

I desire to record recognition to Miss Elsie French for her devoted and careful secretarial assistance.

GEORGE WASHINGTON STEPHENS

Chesterfield Chambers,
Montreal
January 20, 1930

Chapter I

TREATIES, BOUNDARIES, WATERWAYS, 1713-1929

"All who deliberate on important matters, ought to be uninfluenced by hatred, friendship, anger or compassion."—Sallust.

"By union the smallest states thrive, by discord the greatest are destroyed."—Sallust.

Chapter I.[1]

No one who desires to know the significance of the St. Lawrence Waterway project of to-day can afford not to make himself familiar with the history of North America, the treaties affecting its territorial division, and how the present boundaries came into existence.

During the last two hundred and twenty years, the period between 1710 and 1929, there have been negotiated fourteen important treaties between Great Britain's Sovereigns and the United States affecting the possession of territory, and the waterways and boundaries on the North American continent. These treaties have a bearing upon all the lakes, rivers, canals, streams, bays and gulfs associated with the international boundary between Canada and the United States, or where the question of navigation becomes a joint problem between the two countries.

A brief study of them will show how continental America grew up, and how it emerged from the international struggle for expansion waged by the ambitious nations of Europe in the New World. It will also show that legend and myth have intermingled with fact to create many biassed points of view in connection with their negotiation and awards.

After the discovery of America at the end of the fifteenth century, the adventurous spirit of European nations quickened and took shape. England, France, Spain and Portugal vied with each other for supremacy in the New World. Before the treaty-making era arrived in America these four nations were the contending pioneers for trade and possession. France,

(1) See footnote, p. 21.

in the north, through the wilderness of the great beyond, past the Great Lakes and down the Mississippi to New Orleans; Britain, fringing the Atlantic Ocean with her concessionary possessions and provinces; Spain, east of the great river, in the Floridas and Cuba, and west of the Mississippi, in that tremendous territory of Louisiana, extending from the Gulf of Mexico to the unknown boundaries in the north; and Portugal in the West Indies.

TREATY OF UTRECHT, 1713

In Europe, at the beginning of the eighteenth century, the War of the Spanish Succession was convulsing that continent. The struggle had gone on for twelve years, from 1701 to 1713, when the victories of the Duke of Marlborough in Flanders and the Archduke Charles in Spain, forced the French King to sue for terms. The Treaty of Utrecht was the outcome of Louis's request. He gave up Newfoundland. He gave up Acadia (Nova Scotia), but without its boundaries being accurately defined. He likewise surrendered the Hudson Bay region, and the French were ordered to evacuate the posts they held there. It was finally decided that France should retain the islands in the Gulf of St. Lawrence—the principal ones being Cape Breton and Isle St. Jean, or Prince Edward Island—and her right to fortify them was acknowledged by the plenipotentiaries of Britain.

The sovereignty of Great Britain over the Iroquois, or Five Nations, was recognized by the Treaty of Utrecht, which stipulated that the French should not interfere with them, nor with the other Indians who were friendly to Great Britain. On the other hand, the British were not to interfere with those Indians who were subjects and friends of France. The sub-

jects of both countries, however, were to be free to trade with all the Indian tribes, and the Indians were to have freedom to trade with the colonies of either power.

The Treaty of Utrecht left unsettled many questions affecting the strength, development and even the existence of Canada. The principal questions at issue were the limits of Acadia, the boundary between the British colonies and New France, and between those colonies and the regions bordering on the Mississippi and its tributaries. The boundary was never determined by the commissioners appointed, and it remained unsettled until Canada became a British province. It was defined by the Imperial Act of 1889, 52 and 53, Vict. cap. 28, which settled the northern boundary of Ontario.

The "ancient boundaries" referred to in Article XII of the treaty are thus given by Murdoch:

> Acadia was then bounded on the north by the Gulf of St. Lawrence, on the east by the Atlantic, on the south by the river Kennebec, and on the west by the Province of Canada, its northwesternmost boundary being in Gaspé Bay.

Thus defined, though disputed by France, Acadia included the present Provinces of Nova Scotia and New Brunswick, and part of the State of Maine. The St. Croix River is named as the boundary, instead of the Kennebec, in the commission to Walter Paterson, the first Governor of Prince Edward Island, in 1769. This definition was repeated in the commission to Thomas Carleton, 1784, the first Governor of New Brunswick.

TREATY OF PARIS, 1763

During the fifty years that followed the Treaty of Utrecht, much happened in North America, the most important event being, perhaps, the surrender of Quebec and the deaths of

Wolfe and Montcalm in 1759. By the Treaty of Paris, signed February 10, 1763, France took leave of the western world, thus giving up the fruits of two centuries of effort in the field of colonization.

In 1756 Frederick the Great attacked Saxony and so began the Seven Years War. This was brought to a close in 1763 by the Treaty of Paris, which was made between Great Britain, France, Spain and Portugal. The disposition of the prizes caused serious agitation in England and many forces were operating to determine the destiny of Canada. Pitt's reign had ended with the death of George II in October, 1760. Following the succession of George III, Lord Bute and other personal favorites of the King, assumed the direction of British policy.

To George III and his party, Pitt and his "bloody and expensive war" were alike distasteful, and it was their hope

---

(1) Principal sources consulted in writing Chapter I:

Treaties and Agreements affecting Canada in force between Great Britain and the United States of America, 1814-1925. Royal Colonial Institute Journal, October 1911, article by Lieut.-Col. D. A. Mills. *Collection of Treaties Between Great Britain and other Powers. Documents Relating to the Constitutional History of Canada, 1759-1791. Treaties between His Most Christian Majesty and the Thirteen United States of America. Observations upon the Treaty of Washington signed, August 9, 1842 with the Treaty annexed.* Sir Francis Hincks's speech at Montreal, June 9, 1885, and his pamphlet on Oregon Treaty. *Canadian Historical Review,* articles by George W. Brown, March, 1926, and September, 1928. *Memoirs of the Right Honourable Sir John Alexander Macdonald, G.C.B. A History of Nova-Scotia, or Acadie. Canada and Its Provinces,* various volumes. *Encyclopedia Americana,* Vol. XX.

that by concluding the war the foundation of Pitt's influence and popularity would be shattered. Had Pitt's method of following up to the full the advantages of his more recent conquests been followed, Great Britain would probably have been in a position to dictate the terms of peace. But now the war policy was discontinued, and the negotiations were entrusted to the advocates of compromise.

The problem which British statesmanship was now called upon to solve was—which of the conquered territories should be retained and which should be restored to the French? The economic principle of selection led to the choice of Canada. By the Treaty of Paris, therefore, France renounced all claim to Nova Scotia and ceded to Britain—Canada, Cape Breton and everything which depended upon them.

In the first Treaty of Paris, 1763, Great Britain, France, Spain and Portugal took part. This was the momentous treaty that gave to Great Britain almost complete possession of North America from Hudson Bay to the Gulf of Mexico. It was concluded at Paris, February 10, 1763, and its terms are quaint and almost mediaeval. It begins: "In the name of the Most Holy and Undivided Trinity, Father, Son and Holy Ghost, so be it." The High Contracting Parties were: The Most Serene and Most Potent Prince George III, by the Grace of God King of Great Britain, France and Ireland, Duke of Brunswick and Lunenbourg, Arch-Treasurer and Elector of the Holy Roman Empire. The Most Serene and Most Potent Prince Louis the Fifteenth by the Grace of God Most Christian King. The Most Serene and Most Potent Prince, Charles the Third, by the Grace of God King of Spain and the Indies. The Most Serene and Most Potent Prince Dom Joseph the First, by the Grace of God King of Portugal.

Plenipotentiaries: Great Britain: The Most Illustrious and Most Excellent Lord, John, Earl of Bedford, Marquis of Tavistock. France: The Most Illustrious and Most Excellent Lord, Caesar Gabriel de Choiseul, Duke of Praslin. Spain: The Most Illustrious and Most Excellent Lord, Don Gerome Grimaldo. Portugal: The Most Illustrious and Most Excellent Lord, Martin de Mello and Castro.

Under Article II this treaty confirmed and renewed all the treaties between the contracting parties from the Treaty of Westphalia, 1648, to the Treaty of Madrid, 1750.

Under Article IV France renounced all pretensions to Nova Scotia or Acadia in all its parts, and ceded to Great Britain in full right, " Canada with all its dependencies, Cape Breton and all the other islands and coasts in the Gulf and River St. Lawrence," except the islands of St. Pierre and Miquelon.

Under Article VII it was agreed, for the future, that "the confines between the dominions of His Britannic Majesty and those of The Most Excellent Christian King, should be fixed irrevocably by a line drawn along the middle of the River Mississippi from its source to the sea, France ceding to Great Britain the River and port of Mobile, and everything on the left side of the Mississippi except the island and town of New Orleans, provided that "the navigation of the Mississippi shall be equally free to the subjects of both nations."

Under Article XX Spain ceded to Great Britain all the Spanish possessions on the continent of North America east or south-east of the River Mississippi.

Under the treaty, the British possessions in America were enlarged by the addition of New France (Canada) and the Spanish possessions east of the Mississippi, practically all that

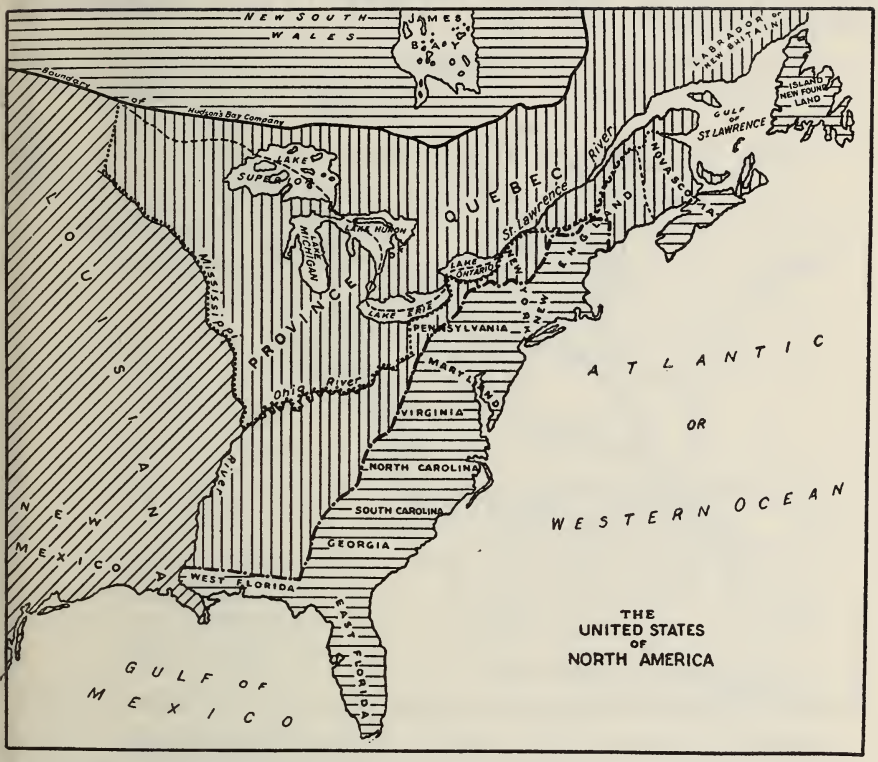
was then of importance from Hudson Bay to the Gulf of Mexico.

ROYAL PROCLAMATION UNDER THE TREATY OF PARIS, 1763

On October 7, George III appointed by Royal Proclamation four Governments—Quebec, East Florida, West Florida, and Grenada. By a judgment of Lord Chief Justice Mansfield, which has never been reversed or questioned in a court of law, this proclamation is declared to have been the Imperial Constitution of Canada during the years 1763-1774. In the latter year it was superseded by the Quebec Act. The purpose of the proclamation was "to erect within the countries and islands ceded and confirmed to us by the said treaty, four distinct and separate governments, stiled and called by the names of Quebec, East Florida, West Florida, and Grenada." The limits and bounds were as follows: (See Faden's map, 1783, facing this page) Quebec, from the St. John River on the Labrador coast to Lake Nipissing, thence crossing the St. Lawrence, following the 45th parallel to Lake Champlain, passing along the highlands which divide the rivers that empty into the St. Lawrence from those which fall into the sea; East Florida; West Florida; Grenada, Islands of Grenada, Grenadines, Dominico, St. Vincent and Tobago. Under this proclamation the southern boundary of Quebec in the east was fixed at the watershed of the St. Lawrence River. In 1774, by Act of Parliament, the southern boundary of Quebec in the west was moved southward to the Ohio River.

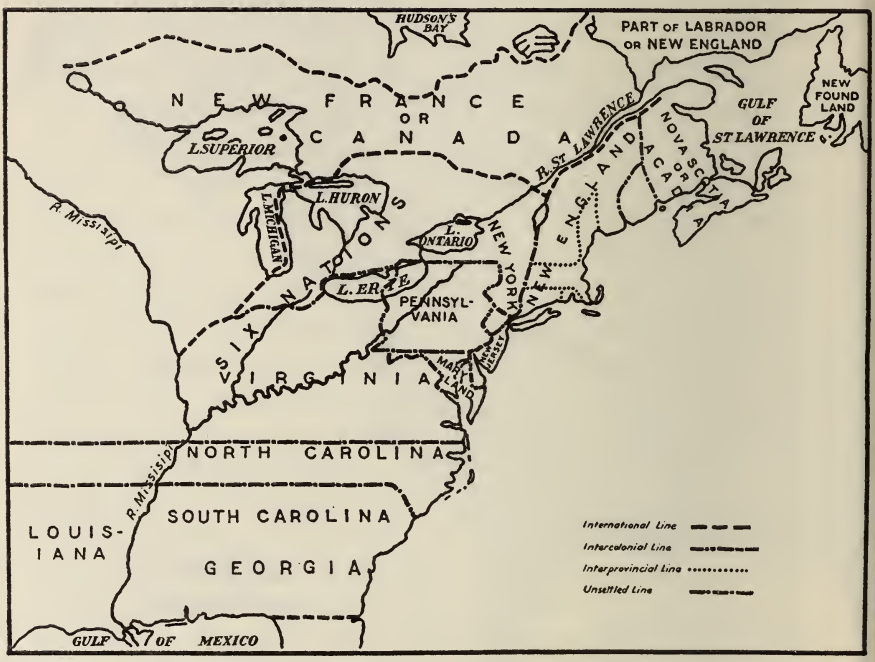
At this time the British Provinces (afterwards the thirteen original states) occupied a fringe fronting the Atlantic Ocean and extending westward as far as the Appalachian Mountains, and from the boundaries of New France in the north

FADEN MAP 1783



Published by courtesy of the Public Archives of Canada, Ottawa. This map was used at the time of the first Treaty of Paris, between Great Britain and the United States of America, whereby the latter achieved independence. Labrador was called New Britain; the present Canadian west was then New South Wales, and the Province of Quebec extended almost to the Gulf of Mexico.

Mitchell's Map 1755, 2nd Edition



Published by courtesy of the Public Archives of Canada, Ottawa. This map shows the boundary between New France and the original British Possessions in North America. Note the boundary between New England and New France at the watershed of the St. Lawrence.

to the Floridas in the south. Beyond to the westward was the "Six Nations Country," possessed by the Indians under various treaties, ceded by France to England in the terms "the country possessed by the Six Nations." (See Mitchell's map, 1755, facing this page)

The country south of the Ohio, as far west as the Mississippi to the Gulf of Mexico, was called West Florida. Beyond, and west of the Mississippi, was Louisiana, a great territory extending from the Gulf of Mexico northward into the unknown land of fur and buffaloes, belonging in turn to the Indians, France, Spain, and ultimately to the United States. (See Faden's map, page 24). This situation, lasted, however, only a short time, from 1763 to 1783.

Under the Treaty of Paris, 1763, and the subsequent Royal Proclamation, Great Britain became possessed of practically all the territory of the eastern half of North America. The proclamation also placed under the King's "Sovereignty, Protection and Dominion" for the use of the Indians, all territories not included in Quebec, East Florida, or West Florida, "or within the limits of the territory granted to the Hudson's Bay Company, as also all the lands and territories lying to the westward of the sources of the rivers which fall into the sea from the west and north-west as aforesaid." (See Mitchell's map).

What principles shaped Great Britain's attitude towards Canada? The country had been acquired by conquest. Canada was taken over in 1763 because it afforded an excellent field for settlement; also because it was capable of being developed into a valuable market for British produce. So far as trade was concerned, Canada came within the same category as the American colonies and received the same treatment.

What the atmosphere was like twenty years later in England is well portrayed in an open letter by one signing himself "Portius," dated London, February 5, 1783, and addressed to the Earl of Shelburne (Prime Minister of England).

My Lord,

If I address the following sheets to your Lordship in preference to any other person of eminent rank or distinguished talents, it is assuredly neither from any motives of interest or any propensity to flattery. You have been selected from the crowd of nobility who surround the throne, to conduct the affairs of a mighty empire, which, though it has sustained the rudest shocks and suffered numerous dilapidations, is still sublime and magnificent in ruin.

You have undertaken this arduous employment at a moment big with internal discord and external calamity. . . . As if unusual calamities had combined for our destruction, the torch of war was lighted almost at the same moment of time in the two most important and widely separated parts of the British Dominions. (India and America.)

France united her formidable force to that of Asia and America. . . . Spain joined her unwieldly strength to that of the older branch of the House of Bourbon.

The imbecility and insanity of our councils in the East invited new enemies. . . . To complete the unexampled assemblage of enemies, Holland awakened from a repose of nearly half a century, buckled on her armour and unsheathed her sword to give another stab to a country which seemed already fainting beneath an unequal struggle. . . .

Incapacity and negligence seemed to combine for our destruction. America, advancing gradually from political distress to emancipation and freedom, treated with contempt every advance towards peace, unless her independence was acknowledged as a Preliminary Article.

Spain captured Minorca, West Florida and the Bahamas. . . . The sublime and superior talents of Mr. Hastings were alone equal to sustain the tottering fabric of East Indian greatness.

Such, my Lord, was the distressful state of the Empire at the commencement of the year 1782.

Pride of possession seemed to swell the heads of the far off British rulers, who attempted to deny to their own flesh and blood in America the liberties which they themselves

enjoyed. The Government at home considered it proper that the American colonists in whose interest the war had been fought, should bear part of the heavy financial burden entailed, but their methods of collection were regarded as an infringement of the constitutional rights of the colonies. A quarrel ensued, and the colonies declared their independence in 1776, which was recognized by Great Britain in the Treaty of Paris, 1783. Only twenty years before England had come into possession of practically all America. Now she was to sign the treaty that lost her almost an empire.

TREATY OF PARIS, 1783

Few events have had a greater or more permanent influence on the destiny of the Canadian people than the revolt of the American colonies and the recognition of their independence. Having resisted successfully the attempts of the Americans to conquer the country, Great Britain perceived that it had a new problem in colonial government on its hands. No more colonies were to detach themselves from the Crown for the same reasons as had led the Americans to begin a separate career. Thereafter, as one of their statesmen said, Canada must be governed on such principles that its people should have no occasion to envy Americans their liberty. The evolution of those principles was a slow, gradual process. Under the ceaseless pressure of Canada, the British Government learned little by little the great truth that colonies of free men could be held by the Mother Country only when they were allowed to enjoy perfect liberty in the management of their own affairs. The example of the United States was a constant impelling force driving Canada towards her ideal. When that was attained, there ensued a friendly rivalry between two systems of government, which is still in existence.

For geographical information, when drawing up the treaty, the negotiators relied on Mitchell's map of North America, a line reproduction of which faces page 25. While it was, in many respects, a great advance on any map that had up to this time made its appearance, the fact that much of the country was unexplored, and that information that had been obtained from the French was not all available, made anything like accuracy impossible. The result of incorrect and unreliable descriptions was that, on more than one occasion, the two nations were brought almost to the verge of hostilities, and an additional difficulty arose from the fact that when negotiations were concluded, the plenipotentiaries did not agree on an official map and attach it to the treaty.

This famous treaty of 1783, signed at Paris, was called a "Treaty of Peace and Friendship between His Britannic Majesty George III and The United States of America." David Hartly, M.P., and assistants acted on behalf of Great Britain, and the United States were represented by Benjamin Franklin, Minister to the Court of Versailles; John Adams, Minister to the United Netherlands; John Jay, Minister to the Court of Madrid.

"In the Name of the Most Holy and Undivided Trinity," the signatures were appended, and under Article I, New Hampshire, Massachusetts Bay, Rhode Island and Providence Plantations, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Virginia, Maryland, North Carolina, South Carolina, and Georgia, were declared free sovereign and independent states.

The boundaries between Canada and the United States were described as follows:

Article II: East by a line drawn along the middle of the River St. Croix from its mouth in the Bay of Fundy, to its source, and from its source directly north to the aforesaid highlands, which divide the rivers that fall into the Atlantic Ocean from those which fall into the St. Lawrence River.

From the north-west angle of Nova Scotia, formed by a line drawn due north, from the source of the St. Croix to the highlands, along the said highlands, which divide those rivers that empty themselves into the River St. Lawrence from those which fall into the Atlantic Ocean, to the northwesternmost head of Connecticut River, thence down along the middle of that river to the 45th degree of north latitude; from whence by a line due west on said latitude until it strikes the river Iroquois (St. Lawrence), thence through the middle of the river (St. Lawrence) and Great Lakes, and water communications between the Great Lakes, westward to the Lake of the Woods, thence west to the Mississippi, thence down the middle of the rivers Mississippi, Flint, St. Marys to the Atlantic Ocean.

Article VII stipulated that the navigation of the River Mississippi, from its source to the Ocean should forever remain free and open to the subjects of Great Britain and the citizens of the United States.

TREATY OF AMITY, COMMERCE AND NAVIGATION, 1794

In the ensuing years the need of a commercial agreement made itself felt to cover the to-and-fro access of citizens of both countries, and so a Treaty of Amity, Commerce and Navigation was negotiated and signed in London, 1794, between His Britannic Majesty and the United States of America. The plenipotentiaries were: Right Hon. William Wyndham, Baron Grenville, Secretary of State for Foreign Affairs; and John Jay, Chief Justice and United States Ambassador.

Under Article III of this treaty all boundary waters were declared to be equally free for navigation purposes, as well as the Mississippi River:

> It shall at all times be free to His Majesty's subjects and to the citizens of the United States, and also to the Indians dwelling on either side of the said boundary line, freely to pass and repass by land or inland navigation. . . . and to navigate all the lakes, rivers and waters thereof and freely to carry on trade and commerce with each other. . . . The River Mississippi shall, however, according to the Treaty of Peace, 1783, be entirely open to both parties.

Under Articles IV and V, commissioners were appointed to make a joint survey of the sources of the Mississippi, to regulate the boundary in that quarter, and joint commissioners were to determine what branch of the River St. Croix mentioned in the Treaty of Peace, 1783, was truly intended to be the boundary.

This treaty, by a judgment rendered in a United States Court in 1929, has been declared as falling under the class of treaties automatically annulled by subsequent war between the contracting parties; in this case by the war of 1812. It is a question for jurists to decide whether, under international law or practice, all treaties are not automatically annulled by a subsequent war between the contracting parties. If this holds good under international law it would also annul the treaty of 1783.

At the time the situation was somewhat as follows:

For fifty years, from 1713 to 1763, Great Britain and France each claimed the land between the St. Lawrence River and the Bay of Fundy. No definite boundary existed between Nova Scotia and New England. In 1763 Great Britain came into possession by conquest of all the French territories in North America, except the Island of New Orleans. This gave her full possession of practically the whole continent, which was immediately divided into four governments, by Royal Proclamation of George III, in 1763. The southern boundary

of Quebec in the east was fixed at the watershed of the St. Lawrence, and the western boundary between Nova Scotia and New England was proclaimed to be the River St. Croix, and a line due north to the southern boundary of Quebec. Subsequently, Nova Scotia became the Province of New Brunswick and the Province of Nova Scotia, by division.

TREATY OF GHENT, 1814

The Treaty of Ghent was signed in Belgium between His Britannic Majesty and the United States in 1814. The British negotiators were: Right Hon. James Lord Gambier, Admiral; Henry Goulburn, Under Secretary of State; William Adams, Doctor of Civil Laws. The United States negotiators were: John Quincy Adams; James A. Bayard; Henry Clay; Jonathan Russell; Albert Gallatin.

The boundaries agreed to in the Treaty of Paris, 1783, which up to this time had never been ascertained or surveyed, were now to be properly fixed and determined. Commissioners met at St. Andrews, N.B., to decide to whom belonged the islands situated within twenty miles of the coast as intended by Article IV of the treaty of 1783; to fix the point of the highlands lying due north of the River St. Croix as the north-west angle of Nova Scotia; to survey that portion of the boundary line from the source of the St. Croix to the 45th degree of north latitude at the Iroquois or St. Lawrence River.

Under Article V a map of the boundary line conforming to the provisions of the treaty of 1783 was to be made and accompanied by a solemn declaration, under the commissioners hands and seals, that it was a true map, and such map was to be considered by both the contracting parties as conclusively fixing the boundary.

The commissioners appointed under Article V to determine the boundary between Maine and New Brunswick sat for six years, and surveyed without result. The matter was submitted to the King of the Netherlands, whose award, on January 10, 1831, was rejected by the United States. Although Great Britain was at first willing to concur, under the impression that the arbitrator's decision was final, she ultimately advised the United States that she could not accept.

Other joint commissioners, meeting at Albany, were to designate the boundary from where the 45th parallel strikes the River Iroquois or St. Lawrence through the middle of the river, lakes and water communications as far west as the north-western point of Lake of the Woods, "in conformity with the true intent of the said Treaty of 1783."

ASHBURTON-WEBSTER TREATY, 1842

Between the years 1814 and 1842, the outstanding event was the Act of Union in 1840 which united Upper and Lower Canada. Two years later came the Ashburton-Webster Treaty, which ranks among the most contentious that Great Britain and the United States have ever been called upon to negotiate, and by it there was solved by compromise a problem that had been a source of irritation for more than half a century. This problem was the boundary line between Maine and New Brunswick.

Lord Ashburton has been censured for making this treaty by people who know little of the merits of the question. It was certainly a favorable one from the British point of view. Lord Ashburton obtained the best boundary that was possible at the time, and it is safe to say that it would not have been agreed to at a later period. Subsequent to the treaty, a British and a United States commissioner were appointed to

trace and mark the boundary between the British possessions in North America and the United States. Five years later, on June 28, 1847, the commissioners completed their work and submitted reports and maps to their respective governments.

No insurmountable difficulty was found in determining any portion of the international boundary except in the east between Nova Scotia and the State of Maine. This boundary had been fully described and agreed upon in the Treaty of Peace, 1783, and again in the Treaty of Ghent, 1814, but had never been definitely determined. No one seemed able to say which branch of the St. Croix River was referred to, nor which of the highlands in northern Nova Scotia was meant by the treaty of 1783. Commission after commission deliberated without success, till finally in 1831 the whole matter, by mutual consent, was referred to the King of the Netherlands.

"The Dutch Award," though far more favorable to the United States than to Great Britain, was rejected by the former, and in consequence allowed to lapse by the latter. Things dragged along for another ten years with no progress to record until, under pressure of advancing settlement, the matter again came to the fore. Up to 1838 the United States claimed "the full extent of all territory in dispute." By 1841, the State of Maine, in its legislative proceedings was offering to compromise the dispute. The boundaries had been fixed and agreed upon under the treaty of 1783, but had never been surveyed. The real business of the Ashburton-Webster Treaty was to fix the boundaries by a true interpretation of the treaty of 1783. If this could not be done, war or a compromise settlement, was the only alternative.

The disputed territory amounted to some 6,851,000 acres, fixed by the British astronomer, Dr. Tiarks, in 1818. By

award of the King of the Netherlands in 1831, which was rejected by the United States, there was assigned to England 2,636,130 acres, and to the United States 4,851,000 acres. The actual distribution under the Ashburton-Webster Treaty is in the proportion of: United States, 3,413,000 acres; Great Britain, 3,337,000 acres. Almost an equal partition of the territory in dispute.

Attention was then given to the western boundaries. By the treaty it is provided that:

> Article II: . . . all the water communications, and all the usual portages along the line from Lake Superior to the Lake of the Woods, and also Grand Portage from the shore of Lake Superior to the Pigeon River, as now actually used, shall be free and open to the use of the subjects and citizens of both countries.
>
> Article III: . . . where . . . the River St. John is declared to be the line of boundary, the navigation of the said river shall be free and open to both parties, . . .
>
> Article VII: . . . the channels in the River St. Lawrence on both sides of the Long Sault Islands and of Barnhart Island, the channels in the River Detroit, on both sides of the Island Bois Blanc, and between that island and both the Canadian and American shores, and all the several channels and passages between the various islands lying near the junction of the River St. Clair with the lake of that name, shall be equally free and open to the ships, vessels, and boats of both parties.

OREGON BOUNDARY TREATY, 1846

Between Great Britain and the United States the Oregon question involved the right to the territory upon the Pacific coast of North America extending eastward to the Rocky Mountains, and bounded upon the south by the parallel of 42° N. latitude, upon the north by the parallel of 54° 40′, which marked the southern limit of what formerly was Russian America. The claim of the United States to this territory was based upon the discovery, on May 11, 1792, of Captain Robert

Gray of Boston who, in the ship *Columbia,* entered the river called Oregon by the Indians.

A second claim was based on the exploration of Meriwether Lewis and William Clark, who had been sent out with a party by the United States Government in 1804, across the newly-acquired Louisiana territory. Priority of settlement was claimed for the United States on account of the fact that a party had been despatched there under the auspices of a company of which John Jacob Astor was the head. Great Britain took this post and others in 1813 but, by Article I of the Treaty of Ghent, they were restored to the United States in 1818. The last item of claim was based on the Treaty of Louisiana between the United States and France in 1803, as well as on the Treaty of Florida, concluded with Spain in 1819. By the latter, Spain conveyed to the United States all her rights, claims and pretensions to the country west of the Rocky Mountains and north of the 42nd parallel.

By the Convention of Commerce of October 20, 1818, between Great Britain and the United States, the boundary line between British America and the United States was fixed at the 49th parallel from Lake of the Woods to the Rocky Mountains. West of the Rockies the line was not defined, but it was agreed that the Oregon country with its harbors, bays and rivers, should be open for a term of ten years to the vessels, citizens and subjects of either power. The agreement was renewed in 1827 but the boundary remained unsettled. The period of renewal was terminable at the discretion of either power on twelve months' notice.

In 1843 President Tyler's annual message called the attention of Congress to the Oregon boundary and stated the

United States claim as embracing the country from the 42nd parallel to that of 54° 40′.

The claims of Great Britain were similar to those of the United States. In 1778 Captain Cook visited and explored the north-west coast of America from latitude 44° northward. Between 1792 and 1794, Captain Vancouver, for the British, surveyed the coast and its adjacent islands. In point of accuracy and authenticity these discoveries were said to be superior to those of any other country. In 1793, Alexander Mackenzie, a British subject, had crossed from the Rocky Mountains to the Pacific, exploring the upper waters of Fraser's River, which in process of time was traced to its junction with the sea near the 49th degree of latitude, thus forming, in point of exploration, a counterpoise to the exploration of that part of the Columbia River which was first visited by Meriwether Lewis and William Clark.

Great Britain denied the validity of the Spanish claim to the Oregon country, and all claims and counter-claims, with various modifications, were discussed at different times by the diplomatic representatives of Great Britan and the United States between the years 1826 and 1846. It had been hoped that the Ashburton-Webster Treaty of 1842 would have settled the Oregon boundary line, but such was not the case. The question became one of the political issues before the people of the United States in the Presidential Election of 1844. Much feeling was aroused; the Democratic Party, after James Polk's election, proceeded to carry out its policy of expansion by seeking to extend its territory to the Russian line, while Great Britain seemed equally determined to retain the line of the Columbia River.

The United States Administration escaped from its "fifty-four forty or fight" position by taking the advice of the Senate in advance of the treaty that was shortly to be signed. A resolution, amended by the Senate, and given a conciliatory tone, passed Congress in April, 1846. By that time, the Administration must have seen its future course clear, for by the middle of June the diplomatic representatives of Great Britain and the United States had come to an agreement which was ratified by the respective countries, and proclaimed to be in force as from August, 1846. The line agreed upon was the parallel of 49° to the Straits of Fuca, thence following approximately the middle of that strait to the Pacific Ocean.

War with Mexico broke out contemporaneously with the settlement of the Oregon boundary question, and as a result of the war and the settlement combined, the United States acquired its present sovereignty over the great territory west of the Rocky Mountains, with a frontage of some 1,500 miles to the Pacific Ocean.

TREATY OF RECIPROCITY, 1854

About the middle of the nineteenth century, there sprang up in Canada a desire to secure for American vessels the free navigation of the St. Lawrence River, upon which so much money had been spent, so that they might be induced to carry their grain from the head of the Great Lakes through to Montreal without transhipment. Reciprocally, Canadian farmers were anxious to gain access to American markets from which, in 1848, they had been shut out by prohibitive duties. It was hoped, therefore, to obtain by negotiation an exchange of favors.

In 1847 the British Government granted a partial suspension of the Navigation Law applicable to the carrying trade of

the St. Lawrence, pending an exhaustive investigation of the whole subject, which was undertaken during the same year. By this suspension foreign vessels going in ballast to the St. Lawrence might take grain to any port in Britain on obtaining a licence from the competent authority at Quebec. It was hoped that reciprocal arrangements might be speedily concluded because an increasing amount of western Canadian trade was being carried by way of American ports. The British Government agreed that the Americans should be granted free navigation of the St. Lawrence River if Canada so desired, but on the understanding that the privilege might be withdrawn at the pleasure of the British Government.

Since 1836 Canada had from time to time urged the British authorities to take up with the United States the question of reciprocal trading with the Dominion. Nothing, however, was done until the repeal of the Corn Laws in Great Britain made the Government of that country anxious to find a market for Canadian produce in every possible direction. In 1846, Mr. Gladstone had promised to have the matter enquired into by the British Minister at Washington, and at this time some correspondence did actually take place.

Lord Elgin, who arrived in Canada as Governor-General in 1847, immediately opened the question. He proposed to combine the granting of free navigation of the St. Lawrence with a request for the free admission of Canadian produce into American markets. He considered also that a special treaty, involving mutual concessions, rather than an Act of Congress, would be more likely to find favor with the people of the United States, and give less ground for adverse criticism.

In July, 1847, William Hamilton Merritt introduced his reciprocity resolutions in the Provincial Parliament. In the following year a delegation from Canada visited Washington to advocate the claims of reciprocity. A Bill in favor was introduced in the House of Representatives and passed. In 1849 Canada passed an Act offering free reciprocal trade to the United States in certain specific articles, covering the natural products of the farm, the mine and the forest. In 1850 the Committee on Commerce brought in a Bill which provided for the free navigation of the St. Lawrence River. President Taylor also took the matter up in a favorable message to Congress.

Little progress was made during 1851 and 1852 beyond attempts to enlarge the scope of the proposed reciprocal measure. In the following year, however, the terms of a treaty were agreed upon although they were not finally settled until June, 1854, owing to the difficulty of securing the consent of the various provinces and of the United States Senate. The treaty, as finally concluded, came into operation in Canada in October, 1854, and in the United States in March, 1855.

The treaty contained seven articles. The first granted to the United States certain privileges of inshore fishing; the second gave similar privileges to British subjects in American waters; the third contained a list of products that were granted reciprocal free trade; and the fourth gave America the right to navigate the St. Lawrence below the point where it ceases to be the boundary, as well as the canals in Canada used as part of the water communication between the Great Lakes and the Atlantic Ocean. Under Article V, the treaty was to continue in force for ten years, but it might afterwards be abrogated by either party on one year's notice .

The treaty survived until April, 1866, when it was terminated by notice from the United States Government. From the first, the professed object of the British provinces had been to obtain access to the large and conveniently situated markets of the United States. There was, however, no equivalent advantage to be offered to the Americans in the limited markets of the British provinces. What had rendered reciprocity acceptable, if not attractive, to them were such features as obtaining the carrying trade of western Canada while retaining that of their own western states; as well as enlarged markets for their manufactured goods. The free navigation of the St. Lawrence had been made to appear attractive as an alternative outlet to the sea, but it had not realized expectations.

When the treaty lapsed it became necessary for all the British North American provinces to adjust their trade relationship and commercial intercourse; hence, it may be said that the abrogation of the Reciprocity Treaty materially contributed towards the union of the provinces and the beginning of a truly Canadian national life.

In the years immediately following the abrogation, Canadian negotiators made several journeys to Washington in an attempt to conclude a new treaty, but their efforts were unsuccessful. The fiscal necessities of the United States at this time, occasioned partly by the Civil War, left no choice to the Government but to raise the tariff wall; therefore, a general abatement in customs dues by the United States in favor of Canada was altogether impossible.

TREATY OF WASHINGTON, 1871

Almost immediately after the Reciprocity Treaty had come to an end in 1866, Canada took a bound forward.

In the space of a little more than a year, New Brunswick, Nova Scotia and Canada became confederated into the Dominion of Canada, with Viscount Monck as the first Governor General. In the same year, the United States purchased Alaska from Russia and, twelve months later, Canada acquired the North-West Territories from the Hudson's Bay Company. The Province of Manitoba was created in 1870 and, in 1871, British Columbia entered Confederation.

The British colonies in Canada now having been welded together for the first time into one Dominion, Great Britain deemed it to be an opportune moment to settle her outstanding grievances with the United States and, as far as Great Britain was herself concerned, she was anxious to find a solution of the long outstanding controversy over the *Alabama* claims. The chief questions of interest to Canada were the fisheries, navigation of rivers and lakes. As far back as the treaty of 1783, citizens of the United States had been granted certain privileges of fishing in British waters, but the war of 1812 had abrogated any rights that may have existed under the treaty. Great Britain, by a convention signed in London in 1818, reached a compromise settlement whereby the liberty of fishing in certain defined waters, and the right of drying and curing fish at certain specified coasts, were conceded to American fishermen. Again, in the Reciprocity Treaty of 1854, Canada's inshore fisheries were opened to Americans, but these lapsed on the termination of the treaty in 1866. A system of issuing licences to fish in Canadian waters was tried but without success.

The British plenipotentiaries of the Treaty of Washington were: the Right Hon. George Frederick Samuel, Earl de Grey and Earl of Ripon; Viscount Goderich; Baron Grantham; the

Right Hon. Sir Stafford Henry Northcote, Baronet; Sir Edward Thornton, Minister to the United States; Sir John Alexander Macdonald, Minister of Justice and Attorney General, Dominion of Canada, and Mountague Bernard, Professor of International Law in the University of Oxford. The United States plenipotentiaries were: Hamilton Fish, Secretary of State; Robert Cumming Schenck, Minister to Great Britain; Samuel Nelson, associate justice of the Supreme Court of the United States; Ebenezer Rockwood Hoar of Massachusetts, and George Henry Williams of Oregon.

The questions adjusted by the treaty included the following: *Alabama* claims; fisheries; claims of corporations, companies or private individuals; navigation of rivers and lakes; San Juan water boundary; and rules defining duties of a neutral government during war.

While it is true that the plenipotentiaries on the British side had received definite instructions to group the principal subjects of reference—the *Alabama* claims, the fisheries, and the San Juan question, so that the commissioners could not agree upon the settlement of one without the others, it would appear that the fisheries question was the most difficult of solution, and caused the most trouble during the negotiations. By April 18, 1871, Sir John A. Macdonald was able to inform the Canadian Government that an agreement had been reached with reference to the *Alabama* claims. These were referred by mutual consent to a tribunal of five nations; one named by Great Britain, one by the United States, one by the King of Italy, one by the President of Switzerland, and one by the Emperor of Brazil.

The fisheries question still remained in abeyance. The first proposal as to a share in the Canadian inshore fishing

was an offer to allow free entry of coal, salt, fish, and lumber to the markets of the United States. This offer was not deemed adequate, Canada wanted to exchange the right of fishing for reciprocal trade rights to be agreed upon. The matter was finally referred to England, and in due time instructions were received "to agree to a settlement of the inshore fisheries on the terms of free fish and a money compensation, the amount to be decided by arbitration, subject to ratification by Canada."

On the arrival in Washington of these British instructions, Sir John A. Macdonald in a letter to Dr. Tupper, said:

> My first impulse, I confess, on the arrival of the cable message from England, authorizing the reference of the value of the fisheries to arbitration, was to hand in my resignation of my position as 'Commissioner, procurator and plenipotentiary' to Lord de Grey for transmission to Earl Granville; and I stated so to the former, and to my other colleagues.
>
> After thinking over it for a night, however, I refrained from doing so, reserving to myself the right of ulterior action. It was fortunate that I did so, else the Articles would have been much worse than they are. The lease of the fisheries would have been for twenty-five years instead of for ten with notice.

Free navigation of the St. Lawrence was also settled on instructions from Britain, the British Government apparently holding that by international law, as then understood, the Americans had really a right to its navigation to the mouth. (Sir John A. Macdonald to Dr. Tupper, April 27, 1871.) ([1])

Free navigation of the three rivers, Porcupine, Stikine and Yukon, was granted to Canada, but the grant of free navigation of Lake Michigan was not given in perpetuity but limited to a definite term of years.

(1) *Memoirs of the Right Honourable Sir John Alexander Macdonald G.C.B.*, by Joseph Pope.

The articles referring to the navigation of the St. Lawrence River and the use of the canals, are as follows:—

Article XXVI: The navigation of the River St. Lawrence, ascending and descending from the 45th parallel of north latitude, where it ceases to form the boundary between the two countries, from, to, and into the sea, shall forever remain free and open for the purposes of commerce to the citizens of the United States, subject to any laws and regulations of Great Britain or of the Dominion of Canada, not inconsistent with such privilege of free navigation. . . . The navigation of the Rivers Yukon, Porcupine, and Stikine, ascending and descending from, to, and into the sea, shall forever remain free and open. . .

Article XXVII: The Government of Her Britannic Majesty engages to urge upon the Government of the Dominion of Canada to secure to the citizens of the United States the use of the Welland, St. Lawrence, and other canals . . .

. . . the United States engages that the subjects of Her Britannic Majesty shall enjoy the use of the St. Clair Flats Canal on terms of equality with the inhabitants of the United States, and further engages to urge upon the State Governments to secure to the subjects of Her Britannic Majesty the use of the several State canals connected with the navigation of the lakes or rivers traversed by or contiguous to the boundary . . .

Article XXVIII: The navigation of Lake Michigan shall also, for the term of years mentioned in Article XXXIII of the Treaty be free and open for the purposes of commerce . . .

Differences of opinion having arisen over the channel boundary between the continent and Vancouver Island as defined in the treaty of 1846, the question was submitted to the arbitration of the Emperor of Germany, whose award was communicated on October 2, 1872, and favored the view of the United States.

The international boundary between Canada and America had now been almost fully described and agreed upon in the preceding treaties. The work of fixing and marking them had yet to be accomplished.

TREATY OF DEMARCATION OF INTERNATIONAL BOUNDARY, 1908

The following treaty between His Britannic Majesty and the United States of America respecting the demarcation of the international boundary between the United States and Canada was signed at Washington on April 11, 1908. The British plenipotentiary was the Right Hon. James Bryce, Ambassador, and the United States plenipotentiary was Elihu Root, Secretary of the State.

Under Articles I and II each party agreed to appoint an expert geographer for the purpose of more accurately defining and marking the international boundary line in the waters of Passamaquoddy Bay, and the line of boundary along the middle of the St. Croix River from its mouth to its source.

Article III provided for the boundary from the source of the St. Croix River to the River St. Lawrence.

Article IV provided that the boundary from its intersection with the St. Lawrence River to the mouth of the Pigeon River be ascertained and established by the International Waterways Commission.

Article V provided that the boundary from the mouth of the Pigeon River to the north-westernmost point of Lake of the Woods be actually fixed by an expert geographer appointed by each country.

Article VI provided for the boundary from the north-westernmost point of Lake of the Woods to the summit of the Rocky Mountains.

Article VII provided for the boundary from the summit of the Rocky Mountains to the Gulf of Georgia.

Article VIII provided for the boundary from the forty-ninth parallel to the Pacific Ocean.

All to be in accordance with the terms of existing treaties and awards.

BOUNDARY WATERS TREATY, 1909

Six months after the ratification of the International Boundary Demarcation Treaty, the Boundary Waters Treaty was negotiated. This most important treaty is the one under

which the International Joint Commission was created to displace the temporary International Waterways Commission.

The treaty was concluded as a result of the desire on the part of both Canada and the United States to prevent disputes regarding the use of boundary waters, and to settle all questions then pending between the two countries involving the rights, obligations or interests of either in relation to the other along the common frontier, and to make provision for the adjustment and settlement of all such questions as might arise in the future.

Boundary waters are defined as "the waters from main shore to main shore of the lakes and rivers and connecting waterways, or the portions thereof, along which the international boundary between the United States and the Dominion of Canada passes, . . . "

> Article I: The High Contracting Parties agree that the navigation of all navigable boundary waters shall for ever continue free and open for the purposes of commerce to the inhabitants and to the ships, vessels, and boats of both countries equally, . . . so long as this Treaty shall remain in force, this same right of navigation shall extend to the waters of Lake Michigan and to all canals connecting boundary waters, and now existing or which may hereafter be constructed on either side of the line.
>
> Article II: Each of the High Contracting Parties reserves to itself or to the several State Governments on the one side and the Dominion or Provincial Governments on the other, . . . the exclusive jurisdiction and control over the use and diversion, . . . of all waters on its own side of the line which in their natural channels would flow across the boundary or into boundary waters; but it is agreed that any interference with or diversion from their natural channel of such waters on either side of the boundary, resulting in any injury on the other side of the boundary, shall give rise to the same rights and entitle the injured parties to the same legal remedies as if such injury took place in the country where such diversion or interference occurs; but this provision shall not apply to cases already existing or to cases expressly covered by special agreement between the parties hereto.

> Article III: It is agreed that . . . no further or other uses or obstructions or diversions, whether temporary or permanent, of boundary waters on either side of the line, affecting the natural level or flow of boundary waters on the other side of the line, shall be made except by authority of the United States or the Dominion of Canada within their respective jurisdictions and with the approval, . . . of a joint commission, to be known as the International Joint Commission.

Notwithstanding the above, each Government, on its own side of the line, may carry out construction work for breakwaters, improvement of harbors, etc., for the benefit of commerce and navigation, which does not affect the level or flow on the other side. Except in cases provided for by special agreement, the construction or maintenance on their respective sides of the boundary of any remedial or protective works, or any dams or other obstructions, the effect of which is to raise the natural level of waters on the other, will not be permitted except when approved by the International Joint Commission.

This is the treaty that governs the uses to which boundary waters may be put, and defines the power that may be called upon to authorize the necessary course of procedure.

BOUNDARY TREATY—PASSAMAQUODDY BAY, 1910

This short treaty of four articles was the outcome of the desire of both Canada and the United States to fix and define the situation of the international boundary line between the two countries in Passamaquoddy Bay, and to the middle of the Grand Manan Channel. The Right Hon. James Bryce, Ambassador Extraordinary and Plenipotentiary at Washington represented His Britannic Majesty, and Philander C. Knox, Secretary of State, acted for the United States. The treaty was signed at Washington on May 21, 1910.

As finally approved, the treaty, besides fixing the boundary, conceded Popes Folly Island to the United States, and the fishing grounds of Lubec to Great Britain.

BOUNDARY TREATY BETWEEN CANADA AND THE UNITED STATES, 1925

The final treaty concerning the international boundary, signed at Washington on February 24, 1925, is unique as being, among the treaties under consideration, the first one of international status to be signed between Canada and the United States direct. It was for the purpose of defining more accurately and completing the international boundary between the two countries.

The plenipotentiaries were: Canada, the Hon. Ernest Lapointe, Minister of Justice; and for the United States, Charles Evans Hughes, Secretary of State. Articles I and II provided for the completion of the survey and demarcation of the boundary line in accordance with the treaties of 1783, 1814, 1842, 1871 and 1908. Article III provided for the adjustment of the boundary line in accordance with the Passamaquoddy Bay Treaty, 1910. Article IV made provision for the proper maintenance of the international boundary line as established under existing treaties.

NIAGARA CONVENTION, 1929

On January 2, 1929, a convention was signed between Canada and the United States at Ottawa respecting the preservation of the scenic beauty of Niagara Falls and the diversion for water power purposes of further water from the Niagara River. The full extent of this convention will be found in Appendix I.

It will have been observed that to describe, survey, mark and chart, and to provide for the maintenance of the international boundary line between Canada and the United States, has required a period of two hundred and sixteen years, and altogether eleven treaties. In the treaties between 1713 and

1929, the principle of the free use, for navigation purposes, of all boundary waters, bays, sea passages, portages and channels, has been recognized in a broad spirit of amity, thus giving to the St. Lawrence-Great Lakes Waterway the character of an international highway from the heart of the continent to the Atlantic Ocean. The navigation of water, wholly or in part within the territory of Canada and the United States, and deemed to be necessary or advantageous to either, has invariably been shared equally by mutual agreement.

It would indeed be strange if, during all these years, and with such mighty issues at stake between two great world powers, differences of opinion had not occurred. It would be unnatural to think otherwise. They did occur; difficulties that called for all that is best in the art of negotiation and diplomacy had to be settled. Not one of these difficulties led to a rupture. When it was not possible to reach a settlement by negotiation arbitration by mutual consent was arranged.

As an example of co-operation and friendly intercourse between two great nations for more than two centuries, this is an example of statesmanlike effort and accomplishment unique in the history of the world.

Chapter II

TRANSPORTATION AND COMMUNICATION

TRANSPORTATION

"Keys with which wise statesmen open new ways of prosperity."—Anon.

COMMUNICATION

"Watt, the man whose genius discovered the means of multiplying our national resources to a degree, perhaps, even beyond his own stupendous powers of calculation and combination, bringing the treasures of the abyss to the summit of the earth; giving the feeble arm of man the momentum of an Afrite; commanding manufacturers to arise, as the rod of the prophet produced waters in the desert; affording the means of dispensing with that time and tide which wait for no man, and of sailing without that wind which defied the commands and threats of Xerxes."—Sir Walter Scott, Answer to the Introductory Epistle, *The Monastery,* 1830.

Chapter II

RATHER more than a hundred years ago there was not a mile of railway nor a vessel driven by steam to be found on the earth; there was no cable nor telegraph, no telephone, no radio nor wireless, no automobile and no aeroplane. To-day, the continents of the world are griddled with a network of steel, and the peoples of the world are in daily communication by cable, wireless and telephone. The oceans are ploughed by steam-driven ships and the air hums with the sound of mechanical wings. The imagination of man and his inventive genius have changed a series of isolated, self-contained states into a world-body of corporate nations, linked together by arteries of communication unthought of a century ago. The economic structure of the whole world has been changed by the inauguration of trade routes across continents and oceans, making neighbors of peoples hitherto unacquainted, and creating more and closer relationships of friendship and trade.

The world is in flux. International relationships, new means of communication, intimacy of interests, moral, financial and material, in their movement of expansion are forever creating new formulae of better understanding between us. Interdependence is slowly taking the place of isolated independence, and transportation in the *deus ex machina* that is bringing this about. The difference between the civilization of the orient and of the occident may be measured by the gulf that separates the ginrickshaw, or man-propelled vehicle, from the automobile; one being man power expressed in terms of

slavery, the other, man power denoted in terms of freedom—freedom made possible through the coming of steam power, electricity and gasoline.

It may not be possible to refute the argument that we are living to-day in an age of machinery, and it is equally impossible to gainsay the fact that the discoveries and inventions of mankind are raising the standard of living for the people of civilized countries to a higher material plane. International trade is the solvent, and transportation is the medium through whose efficient operation the world is becoming more homogeneous and happy.

Less than five hundred years ago, apart from the northern coastline of Africa, there were only two continents on the globe known to civilized man, Europe and Asia. Each of the other continents has gradually swung on its axis into the purview of mankind. All to-day are known, and they are being organized and knit together by ocean transport, railways, cable, wireless and telephone services. Many are reached and are in permanent communication by airship and by aeroplane. The transportation system of each continent has become part of a mighty whole and, according to the efficiency of each individual part, must be measured the powers of import and export of the world's nations. The importance of efficient transport services within a country, therefore, determine in a large measure its national expansion within and its trade development without.

The tendency to-day is toward a drawing together of economic and political units into larger groups just as the merger of business groups into larger consolidations for mass and cheaper production is taking place. Something like the

following is to be seen on the horizon of the future as the great trade and market groupings of the world:

(1)World Groups	Population	Area
United States	120,000,000....	12,500,000 sq. miles
Europe and Colonial Possessions	400,000,000....	10,000,000 "
Russia	150,000,000....	9,000,000 "
China and Japan	450,000,000....	4,000,000 "
British Empire	450,000,000....	15,000,000 "

Without over-stating the case, it may be said with all truth that the part which transportation, or the carrying of persons and goods from place to place, plays in the everyday life of the world is colossal. Wherever the division of labor, and the localization of industry have reached a high degree of development, transportation necessarily attains a correspondingly high importance. The rise of industry on a great scale and the creation of efficient means of transportation mutually govern each other.

The modern organization of industry could never have been established without improved methods of communication between producers and consumers. The railway and the factory have gone hand in hand in their development and in their economic results. With the means of transportation that existed a hundred years ago large industries would have been impossible.

The substitution of turnpikes for common roads, of canals for turnpikes, and of railways for canals, was as essential a part of industrial progress as was the development of the steam engine or of the factory system. Each of these improvements meant at once an increased investment of capital,

(1) *The Empire in the New Era,* by Rt. Hon. L. S. Amery, M.P., p. 10, 11.

a lessened cost of performing the actual work of transportation, and a vastly increased amount of actual carriage of goods. Large capital resources made it at once necessary and possible to accept lower rates for the sake of developing business. The development of business, in turn, made further investments of capital and further reduction of rates possible.(1)

When considering the value of transportation and communication in connection with the Dominion, it must be borne in mind that Canada is a country of magnificent distances, nearly 4,000 miles in length from east to west, with a relatively small population of some 10,000,000 people thinly distributed along the southern borders of its vast area.

Different parts of the country are shut off from each other by sparsely inhabited areas, such as the regions lying between New Brunswick and Quebec and the areas north of Lakes Huron and Superior, the latter dividing the industrial region of Ontario and Quebec from the agricultural areas of the western provinces. To such a country with such a population, producing like the western agriculturalists mainly for export or, like the manufacturers, largely for consumption in distant portions of the country itself, cheap transportation is one of the necessaries of life.

Before 1850, water routes were the chief avenues of transportation in Canada; but railways were even then required for the adequate economic development of the country. The construction of the Canadian Pacific Railway gave to Canada, as an economic unit, length; the building of the newer transcontinental railways has given the country breadth, a fact which in another decade, as settlement fills the exten-

(1) *Palgrave's Dictionary of Political Economy,* Vol. III, p. 574.

sive areas thus opened up, will be more evident than it is to-day.

Railway construction in Canada has been carried out on an extensive scale and this has made available vast agricultural and mineral wealth requiring only population and money for their development. Also, new enterprises have either been undertaken or are under consideration for improving water communication, notably the new and deeper Welland Canal, the deepening of the St. Lawrence canals and of the channel between Montreal and Quebec, and the utilization of the Hudson Bay route for the transportation of western grain to British and European markets.

Transportation services are, therefore, of vital importance to the economic life of Canada and they occupy a large part of the time and thought of the Dominion and Provincial Governments and of public men. Scarcely less important, from the social and from the economic point of view, is the development of methods of communication in a country so big and so underpopulated. The post office has been a great though little recognized factor in promoting solidarity among the people of different parts of the Dominion, while telegraphs and telephones have gone far to annihilate distance.

That the use of the motor car has also been of benefit in promoting intercourse among the dwellers in rural districts is evidenced by the fact that in Ontario alone 99,649 or 29 per cent. of the passenger cars registered in the province during 1926 were owned by farmers.

The press, again, assisted by cheap telegraph and cable rates, and circulating by means of the mails all over the country, has been of great use in developing national sentiment. It may be said, therefore, that the progress of modern inven-

tions, not least among which is the radio, has immeasurably improved conditions in both rural and urban communities throughout the Dominion.(1)

RAILWAY CONSTRUCTION IN CANADA

It is a generally accepted fact that the phenomenal growth of the Dominion during the past hundred years is attributable in large measure to the building of railways. How true this is may be realized by a brief study of the progress that Canadian railways have made since their inception to the present day.

The first railway in Canada was constructed in 1836 between St. Johns, Que., and La Prairie, with the object of shortening the journey between Montreal and New York. At that time travellers were obliged to go by boat from Montreal to La Prairie and thence by stage coach as far as St. Johns. At this point a service of boats took them up the Richelieu River to Lake Champlain and so eventually into the headwaters of the Hudson River. A second railway from Montreal to Lachine was opened in 1847, and a third line to St. Hyacinthe in 1848. In 1850, however, there were only 66 miles of railway in the whole of Canada.

The railway era in the Dominion may be said to have begun in 1851, when an Act was passed for the construction of a main line of railway between Upper and Lower Canada. The result was the completion of the Grand Trunk Railway between Montreal and Toronto in 1856, its extension westward to Sarnia in 1859, and eastward to Rivière du Loup in 1860. The Atlantic and St. Lawrence Railway from Portland, Me., to the Canadian boundary was leased for 999 years, and in 1859, on the completion of the Vic-

(1) *The Canada Year Book*, 1927-28, p. 641.

toria Bridge across the St. Lawrence River at Montreal, the Grand Trunk Railway had a through route 800 miles long from Portland to Sarnia.

There followed in 1881 the absorption by the Grand Trunk Railway of the Georgian Bay and Lake Erie system, and in 1882 the Great Western and the Midland systems were taken over. In 1888, the Northern Railway and the Hamilton and North Western were acquired, and direct communication with the railways of the United States was achieved in 1891 by the completion of the St. Clair tunnel.

An inter-colonial railway between the Maritime Provinces and Canada had been proposed and discussed as early as 1835. By 1867 there were only 341 miles of railway in the Maritime Provinces and these, under the terms of the British North America Act, passed to the Dominion Government on condition that an inter-colonial railway to connect the Maritimes with other parts of Canada be completed. So it was in the west. British Columbia entered Confederation in 1871 on the understanding that within two years the Dominion would commence to build a Pacific railway and complete it within ten years. The construction of this railway actually commenced in 1874, but little progress was made until 1880.

In that year the Government entered into a contract with the Canadian Pacific Railway syndicate, and granted to that syndicate all portions of the line already completed or under construction, a cash subsidy of $25,000,000, a land grant of 25,000,000 acres, free admission of materials for construction, and protection for a period of twenty years against competing lines. The syndicate, on its part, agreed to complete the railway to a fixed standard by May 1, 1891, and there-

after to maintain it efficiently. As a matter of fact, the last spike on the main line was driven on November 7, 1885.

Like the Grand Trunk Railway, the Canadian Pacific Railway also began to acquire branch lines as feeders, among them being the North Shore, Quebec, Montreal, Ottawa and Occidental in 1881; the Winnipeg to Manitou line in 1882; the Ontario and Quebec; the Credit Valley; and the Toronto, Grey and Bruce in 1883; the St. Lawrence and Ottawa; and the Manitoba South Western in 1884; the North Shore, Nova Scotia in 1885; the Atlantic and North West in 1886; the West Ontario Pacific in 1887; the Sudbury and Sault Ste. Marie in 1888; the New Brunswick Railway; the Columbia and Kootenay in 1890; and the Montreal and Ottawa; and the Montreal and Lake Maskinongé in 1892.

The second trans-continental system, the Canadian Northern Railway, was commenced in 1896, and by 1902 it had been completed from Winnipeg to Port Arthur. In the same year, the Grand Trunk Railway submitted a proposal to the Dominion Government for the construction of a line from North Bay to the Pacific coast, but in 1903 the Government came forward with an alternative proposal that the line, instead of terminating at North Bay, should be continued east to Moncton, N.B. This easterly section was to be constructed by the Government, and the western section of the railway, from Winnipeg to Prince Rupert, was to be built by the Grand Trunk Railway. The proposal was accepted and construction was begun on the National Trans-Continental and on the Grand Trunk Pacific Railway.

With two new trans-continental main lines, besides branches under construction, railway mileage in Canada was doubled between 1900 and 1915, increasing from 17,657

miles in the former year to 34,882 miles in the latter. The builders of the new lines, as well as the Canadian Government and people, had expected that immigration of capital and labor from Europe would rapidly settle the areas tributary to the new railways and give them abundant and lucrative traffic, as had been the case with the Canadian Pacific Railway.

Instead, the war came and European capital and labor were conscripted for the struggle. Immigration fell off and the cost of railway operation increased owing to the scarcity of labor and material. Interest on bond issues had to be met, and in 1915 the Government felt it necessary to come to the assistance of the Grand Trunk Pacific and the Canadian Northern Railway.

In 1916, after having again made loans to the Grand Trunk Pacific Railway and to the Canadian Northern Railway, a Royal Commission was appointed by Order in Council on July 13, 1916, to investigate:

(1) The general problem of transportation;
(2) The status of each of the three trans-continental systems:
(3) The reorganization of any of the systems, or their acquisition by the State;
(4) Other matters considered by the Royal Commission to be relevant to the general scope of the enquiry.

Alfred Holland Smith of New York, Sir Henry Drayton of Ottawa and Sir George Paish of London, were originally appointed to the commission. On the resignation of the latter, William M. Acworth, a distinguished English authority on railways, was appointed to take his place.

The majority report of the commission, which was signed by Sir Henry Drayton and William M. Acworth, has formed the basis of the railway policy of the Dominion of Canada ever since. Their recommendation was that the Dominion should take over the control of the Canadian Northern Railway, the Grand Trunk Pacific Railway and the Grand Trunk Railway proper, and that they should be administered on purely business principles by a board of trustees. Such compensation as seemed proper was to be decided by arbitration and given to the stockholders of the Canadian Northern Railway and the Grand Trunk Railway.

After this arbitration had been disposed of steps were taken to consolidate the various railways under Government operation and control. In October, 1922, the boards of the Grand Trunk Railway and the Canadian Northern Railway gave place to a single Canadian National Railways board to which the former Canadian Government railways were turned over for management and operation. The unification was provided for by an Order in Council of January 30, 1923, which Order also brought into effect the act to incorporate the Canadian National Railways Company. ([1])

Such is the history of Canada's railways from their inception to the present time. Ambitious schemes of development have been arranged and others are in contemplation which are calculated to bring the railway facilities of the Dominion to an even higher standard of efficiency, so that in a few years Canada will be one of the best served countries insofar as her land transportation systems are concerned of any in the world.

(1) *The Canada Year Book*, 1927-1928, p. 644-647, 662.

The following table, which has been compiled specially for this publication by Colonel A. E. Dubuc, Chief Engineer, Department of Railways and Canals, Ottawa, indicates the development of Canada's system of railways from 1840 to 1927:

Year	Miles of line	Population	Population per mile of railway
1840	16	1,535,000*	95,940
1850	66	2,375,597*	35,994
1860	2,065	3,171,418*	1,536
1871	2,695	3,689,257	1,369
1881	7,331	4,324,810	590
1891	13,838	4,833,239	349
1901	18,140	5,371,315	296
1911	25,400	7,206,643	284
1917	38,369	8,361,000*	218
1921	39,192	8,788,483	224
1926	40,352	9,390,000*	232
1927	40,572	9,519,000*	234

The capitalization of Canadian railways as at December 31, 1927, was:

Stocks	$ 843,322,625
Debenture stocks	506,926,541
Funded debt	2,287,588,330
Total	$3,637,837,496(1)

* As estimated by Dominion Bureau of Statistics.

(1) Includes Government loans previously included under current liabilities.

WATER TRANSPORTATION

Under this heading, Canadian shipping may be divided into two classes, (1) ocean, and (2) inland. As is the case in most countries with such an extensive coast line, ocean shipping is the more important.

Canadian ocean shipping dates back to the days of the early European fishermen who frequented the shores of Newfoundland and the Maritime Provinces. Ocean-going vessels of that era were crude wooden sailing craft of some 20 or 30 tons, to be entrusted only to skilful and hardy mariners for navigation through almost unknown seas. Later exploration and settlement produced a larger volume of traffic, but it was not until the building of ships in Canada by the French assumed some dimensions that traffic became important.

The first ocean-going vessels in Canada were probably built by Pont-Gravé, one of the first settlers in New France, and soon afterwards Talon and Hocquart, *intendants* of the colony, realizing the advantages offered to the industry by the timber resources available, gave it every encouragement. Shipyards were established at Quebec and at other points along the St. Lawrence and these, together with later undertakings on the west coast, have formed the principal bases of Canadian shipping on the Atlantic and Pacific Oceans.

Canadian shipping attained some prominence in the days of fast wooden sailing vessels, and also at a later date when steam power first came into use. In 1833, the *Royal William,* a Canadian ship built to ply between Quebec and Halifax, crossed the Atlantic from Pictou to London, the first vessel to navigate the ocean under steam power. A few years later Samuel Cunard established the steamship line of that name. His company pursued a conservative course; wooden

ships were used long after iron hulls were a proved success, and paddle wheels after the introduction of the screw propeller. The Allan Line had a somewhat similar early history.

Inland shipping in Canada is associated in its commencement with the birch bark canoe of the North American Indian. The advantages of this light and easily navigable craft were realized by explorers and fur traders, and for many years it was in general use, giving way to more substantial craft only with the demands of heavier traffic. The *bateau* and Durham boat also came into common use after the migration of the United Empire Loyalists. On the St. Lawrence River, and on the other main water highways of the period, they, too, soon gave way to larger vessels. Original plans of the Lachine Canal, which specified for a width of 12 feet and a depth of 18 inches, afford an illustration of the size of these primitive craft.

In the absence of roads to make land travel possible, the St. Lawrence River and the Great Lakes formed the main highway to the interior. The route from Montreal to the upper lakes area was broken at three places; from Montreal to Kingston transportation was by *bateau* or Durham boat; from Kingston to Queenston schooners were used; then there was the portage road from Queenston to Chippawa and, finally, schooner again to destination. The charge of carrying a barrel of rum from Montreal to Kingston was from $3 to $3.50, and freight charges on other goods were proportionate to the rate on this standard article.

In 1809, the *Accommodation,* the first Canadian steamship, was built for the Hon. John Molson, to run between Montreal and Quebec and, by 1818, John Molson had formed a company, the St. Lawrence Steamship Company, or the Molson Line. On Lake Ontario, the *Frontenac,* commencing

in 1817, was used on a weekly service between York and Prescott. Following this beginning came a period of increased activity in lake and river shipping.

In 1845, the *Gore* reached Lake Huron by way of the Welland Canal, to carry on transport trade on the upper lakes where previously there had not been enough traffic to support a large vessel. Upper lakes shipping was becoming more active now partly for the reason that there were settlers to be carried from Buffalo to the western United States and grain to be brought back. In this period Canadian shipping also made a profit by carrying American goods, for there was at this time little traffic originating in the Canadian near west.(1)

SHIPBUILDING IN CANADA

Shipbuilding in the Dominion is an industry that in one sense has passed away, but in another is just beginning. Wooden shipbuilding has gone beyond recall, and the building of steel vessels is only emerging from childhood. The ship's carpenter has departed from the once busy shipyards of Quebec and the Maritime Provinces; but the Atlantic and Pacific ports, and the ports on the Great Lakes, where iron and steel can be cheaply assembled, now resound with the clang of the foundry and the noise of pneumatic rivetters. The story of Canadian shipbuilding is, therefore, both a retrospect and a prospect.

It was during the first seventy-five years of the nineteenth century that the building of wooden ships reached its largest proportions. Shipbuilding flourishes best under a seafaring people, and in the early years of the nineteenth century the products of Canada's farms, mines and factories were not

(1) *Canada Year Book*, 1927-1928, p. 694, 695, 697, 698.

sufficient to provide the traffic necessary for the employment of large ocean tonnage. Consequently, little encouragement was held out for the establishment of a shipbuilding industry on anything like a profitable scale.

But, while the wealth of Canada's mines and lands was still hardly developed, her forests provided a readily available article of commerce, and the early inhabitants set themselves to the task of clearing the land of its trees and selling the timber, the chief market for which was in Great Britain. The forests, therefore, not only furnished the material from which ships were constructed, but also the goods which made the building of ships economically profitable. A large number of the vessels built in Canada were used in the carrying of timber, and when in the course of time shipbuilders increased the output of their yards beyond the need of Canadian timber merchants, few ships were sent to Britain for sale that did not carry cargoes of timber on their maiden voyages across the Atlantic.

Quebec was the headquarters of wooden shipbuilding as well as of the timber industries. Until 1787, however, only a few ships had been built at Quebec, and these were of small tonnage; and it was not until about 1825 that a 400-500 ton ship ceased to be regarded as uncommon. In 1800 twenty-one ships built in Quebec, and having an aggregate tonnage of 3,769, were entered on the register of the local custom house. This period witnessed a remarkable development, no less than fifty-four vessels, with a tonnage totalling 13,691, being registered in 1811.

In 1824 the tonnage registered at Quebec was almost 10,000 tons, or three times the amount registered in the previous year. In 1825 eighty-three ships were recorded with a

total of 24,592 tons. From that time until 1838 the range aggregated from 5,000 to 10,000 tons a year; but in 1840 the tonnage had reached 26,561, the burden of the vessels constructed averaging just over 400 tons.

A setback, however, was in sight. At the time of the union of Upper and Lower Canada, the shipbuilding industry, always, as it is, susceptible to commercial depression, declined as the result of the general adverse conditions then prevailing, and in 1842 the registered tonnage of ships built in Quebec did not amount to one-half the tonnage registered in 1840. The setback proved to be temporary, however, for under the revival that came in its natural sequence, Canadian shipbuilding returned to its previous state of activity.

In 1852 there were twenty-five shipbuilding establishments and eight floating docks in Quebec; and in the following year eighty-nine vessels with a tonnage exceeding 54,000 tons were registered. During the summer of 1855 fifty large ships were launched. In 1864 the shipyards of Quebec launched sixty ships, the largest of them being over 1,600 tons burden. In the following year one hundred and five ships, representing a tonnage of 59,333 tons, were registered.

At Quebec Pierre Brunelle was probably the most famous among the builders; one of his ships, the *Brunelle,* attained a speed of fourteen knots an hour and was claimed to be among the fastest wooden sailing vessels afloat. William Power, draughtsman for Allan Gilmour & Company, was also distinguished for the fast vessels he designed, the most renowned being the *Shooting Star,* and the *Arthur the Great.*

In the latter half of the nineteenth century Canada's maritime industry began to broaden and ships hailing from Nova Scotia and New Brunswick were to be found in all parts of

the world. In 1865, 294 vessels, aggregating over 56,000 tons and valued at $2,500,000 were built in Nova Scotia, while in New Brunswick in the same year, 148 vessels were launched, representing a tonnage of more than 65,000 tons.

From about 1865, however, the increasing use of iron for shipbuilding purposes was sounding the death knell of the Canadian industry. With suitable wood growing scarcer and dearer, and with the strong competition of iron, and later of steel ships, shipbuilding became more and more unprofitable, and by the early eighties most of the builders had transferred to more remunerative commercial pursuits. Today there is practically no wooden shipbuilding carried on in Canada.

Regarding the future, there seems to be every possibility that an extensive steel shipbuilding industry will develop in the Dominion. By 1910 a number of steel ships had been built, and existing dry docks were being extended and constructed at a rapid rate, on both sea coasts and at points on the Great Lakes.

Favorable opportunities for steel shipbuilding exist in Nova Scotia, where coal and iron are to be had in close proximity. The first steel vessel of any size to be constructed in New Glasgow, which is situated in the midst of a coal and iron district, was a steamer of about 300 tons, built in 1893. Subsequently, a number of small steel craft were built, and in 1909 a steel sailing vessel of 700 tons was launched.

For some years now large modern ships have been built on the Great Lakes for service on inland waters. At Toronto the Polson Shipbuilding Company was responsible for the construction of many fine vessels; while perhaps the best

known shipbuilding plant on the Great Lakes so long as twenty years ago, was the Collingwood Shipbuilding Co.(1)

RAILWAYS IN THE UNITED STATES

The railway systems of the United States comprise an aggregate length of lines amounting to approximately 265,000 miles, or about 50,000 miles more than the total mileage of railways in Europe, and about two-fifths of the total of the entire world. Their development is shown in the following table:

Year	Miles of line	Population per mile of railway
1830	40	321,517
1840	2,755	6,194
1850	8,571	2,706
1860	28,920	1,087
1870	49,168	784
1880	87,724	572
1890	159,272	384
1900	192,941	393
1910	240,438	382
1917	254,734	412

As will be seen from the above, prior to 1890 the increase in railway mileage was much more rapid than the growth in population, but since that year railway construction has fallen off, until a comparison between 1890 and 1917 shows an increase of 28, or 7.29 per cent., in the average number of inhabitants served by each mile of railway.

Considering the relative scarcity of capital, the rapidity with which new mileage was added from 1835 to almost the end of the century is remarkable. Baltimore and Philadelphia were connected by railway in 1837, and Boston and Albany

(1) *Canada and Its Provinces,* Vol. X, p. 574-580, 586-588.

in 1842. During 1842 also the last link in the chain connecting Albany and Buffalo was completed.

In 1851, the Hudson River Railroad, following the east bank of the Hudson from New York to Albany, and the New York Lake Erie, connecting the west bank of the Hudson, opposite New York City, with Lake Erie, were placed in operation. The Baltimore and Ohio was extended to the Ohio River, at Wheeling, in 1853, and the Pennsylvania Railroad to Pittsburgh, in 1854. Buffalo and Toledo were connected by rail in 1853, and the year previous witnessed the completion of the third line between Ohio and Lake Erie, the first having been finished in 1848. Chicago was reached by rail in 1852, and the Chicago and Rock Island Railway was extended to the Mississippi River in 1854.

Two years later a second and third line from Chicago westward to the Mississippi were added, and the Illinois Central Railway was built to the junction of the Ohio and Mississippi. The Hannibal and St. Joseph, now part of the Burlington system of railways, was the first line to reach the Missouri River in 1859. In 1866, the Galena and Chicago was built to Council Bluffs, opposite Buffalo, and on May 10, 1869, with the opening of the Central Pacific, and in conjunction with the Union Pacific and with the railways already mentioned, it became possible to travel by rail the whole distance from the Atlantic to the Pacific Ocean.

Thus, the outline of the present American railway system was broadly sketched, the whole process being comprised within the years 1831 to 1866. Subsequent construction has filled in this outline by providing numerous railway routes which parallel those first laid down and supplying old and new railways with feeders, extending their services to im-

portant sources of supplies of raw materials and manufactured products, and to all considerable centres of population.

At present, six great American systems, the New York Central; the Erie Railroad; the Pennsylvania; the Delaware, Lackawanna and Western; the Lehigh Valley; and the Baltimore and Ohio, connect the north Atlantic seaboard with Lake Erie. Four of them, the Pennsylvania; the New York Central; the Baltimore and Ohio; the Erie Railroad, reach onward to Chicago, the three first-mentioned operating to the eastern bank of the Mississippi over their own rails.

In a railway sense, New England remains an independent province, but its railways connect with the trunk lines and serve as collecting and distributing systems for interchanged traffic. Two railways terminating upon Chesapeake Bay, the Norfolk and Western at Norfolk, and the Chesapeake and Ohio at Newport News, compete for traffic between the north Atlantic seaboard and the Mississippi valley, their services being supplemented by those of coastwise steamships with which they have traffic arrangements, enabling the acceptance of freight at through rates for the combined rail and water service.

Three systems, the Southern; the Atlantic Coast Line; the Seaboard Air Line; connect the eastern cotton states with the Potomac River or the Chesapeake. The spring wheat states and those of the corn belt, west and north-west of Chicago, are served by six independent systems, the Union Pacific; the Chicago, Milwaukee, St. Paul and Pacific; the Atchison, Topeka and Santa Fe; the Chicago, Rock Island and Pacific; the Northern Pacific; the Great Northern; and the Chicago and North Western. In addition, these states are served by the Chicago, Burlington and Quincy, a formerly

independent line that is now controlled jointly by the Northern Pacific and the Great Northern Railway.

One of these railways the Chicago, Milwaukee, St. Paul and Pacific, has been extended to Puget Sound and, together with three others, the Atchison, Topeka and Santa Fe; the Chicago, Rock Island and Pacific; and the Chicago, Burlington and Quincy, have been extended or have acquired lines into Kansas City.

Seven lines, the Illinois Central; the Louisville and Nashville; the Missouri Pacific; the Missouri-Kansas-Texas Lines; the Southern Railway; the St. Louis-San Francisco Lines: and the Mobile and Ohio, connect the Gulf of Mexico with St. Louis or Chicago.

Seven trans-continental systems, the Chicago, Milwaukee, St. Paul and Pacific; the Great Northern; the Northern Pacific; the Union Pacific; the Southern Pacific; the Atchison, Topeka and Santa Fe; and the Western Pacific, link the Pacific coast with the Mississippi valley.

Seven railways, the Pennsylvania; the Baltimore and Ohio; the Delaware, Lackawanna and Western; the Reading; the Lehigh Valley; the Delaware and Hudson; and the Western Maryland, serve the anthracite region of Pennsylvania; while in the east, five railways, the Pennsylvania; the Baltimore and Ohio; the Virginian Railway; the Norfolk and Western; and the Chesapeake and Ohio, are specially identified with the heavy traffic in bituminous coal.

Certain railways have been developed to perform functions of a specialized nature. Coal and ore, for instance, are catered for by the Bessemer and Lake Erie; the Pittsburgh and Lake Erie; and the Wheeling and Lake Erie. Again, the Virginian Railway specializes in the carrying of coal; while

iron ore forms a considerable part of the traffic of the Duluth and Iron Range, and the Duluth, Missabe and Northern Railroad. Thus the Pittsburgh district finds its outlet to the region of the Great Lakes and so on to the St. Lawrence River.

There have been considerable changes in the geographical distribution of railway mileage in the United States and, in special reference to the subject of this volume, it may be noted that in 1860 the whole region west of the Great Lakes and the Mississippi River contained only 2,745 miles of line, or 9 per cent. of the country's mileage. In 1917 this region contained 128,733 miles, or nearly 52 per cent. of the total mileage in the whole of America.([1])

The capitalization of the railways in the United States in 1927 was as follows:

Capital stock outstanding	$ 9,539,490,716
Funded debt outstanding	12,309,438,236
Total	$21,848,928,950([2])

SHIPPING AND SHIPBUILDING IN THE UNITED STATES

These allied industries may be said to have commenced with the *Virginia,* which was launched in 1607 at the mouth of the Kennebeck River by the Popham Colony. This small boat was of 30 tons and several times crossed the Atlantic in safety. The first vessel with decks to be built was the *Onrust,* which was launched at New Amsterdam in 1614. In 1621 the *Blessing of the Bay,* launched at Medford, Mass., was the first of the unnumbered fleet which from that time

(1) *The Encyclopedia Americana,* 1925, Vol. XXIII, p. 173-175, and from information supplied through the courtesy of the Canadian National Railways.

(2) Whitaker's *Almanack,* 1929, p. 730.

began to issue one by one down the ways of the colony's shipyards into the waters of Massachusetts Bay. The most conspicuous advance at this time was Dominie Peter's "Great Ship" of 300 tons, launched at Salem in 1641. This notable vessel exceeded the *Mayflower* by 120 tons, and set the pace, not only for the shipbuilders of the New World, but for the Old World as well, where few ships so large had been equal to this product of a mere colony scarcely twenty years old.

By 1676 the ports of Massachusetts had thirty ocean-going vessels of between 100 and 250 tons, besides some 700 smaller ones engaged in the coasting trade. In 1700 Boston was the home port of almost 200 ships, while New York boasted only 124. In the period from 1674 to 1714 the Massachusetts records show the launching of more than 1,000 ships for the American merchant fleet. While Massachusetts and New York had been the pioneers in the industry, the other colonies had quickly followed their example.

In the Earl of Sheffield's *Observations on the Commerce of the American States,* which was published in London in 1783, a record of United States shipbuilding for the year 1769 shows the number of vessels built in that year by each colony. By 1700 Massachusetts was constructing half the total number of ships then being built in America.

In 1791 Alexander Hamilton as Secretary of the Treasury, reported that the American merchant marine then aggregated 476,274 tons. In 1800 the record of shipbuilding was 995 ships with a combined aggregate of 106,000 tons. The greatest effort of production was reached in 1855, the output in that year being 2,027 vessels. The threat of the withdrawal of mail subsidies by Congress had its effect in diminishing shipbuilding, as the best class of vessels could not run without their

help. When the threat was carried out in 1858 the carriage of American mails was transferred to the heavily subsidized ships of Great Britain.

Ship construction on the inland waters of the country began in the year 1800 when the *St. Clair,* a vessel of 110 tons, was launched at Marietta, Ohio, and the *Monongahela Farmer,* 250 tons, was launched at Elizabeth, Pa. The *Louisiana,* 300 tons, launched in 1804 at Pittsburgh, was the most notable of the ships built in the interior in those days. American shipbuilding under the era of steel reached its zenith in 1892 and 1896, when the *St. Louis* and the *St. Paul,* two ocean liners, were built for the International Mercantile Marine by William Cramp and Sons of Philadelphia. These vessels were constructed entirely of American materials thus marking a new era in the shipbuilding activity of the country.(1)

TRIBUTARY AREAS OF THE GREAT LAKES

The foregoing short account of the birth and subsequent growth to maturity of the railway and shipping services of Canada and the United States, leads now to consideration of the question as to how far the means of transportation and communication are adequate for supplying the demands of the territory tributary to the suggested St. Lawrence Waterway. In considering this question, it is important to bear in mind the essential difference between the Canadian and the United States sides of the area, particularly as to population and production.

Canada compares favorably with the United States in territory and resources but, when these resources are considered in terms of production and trade, the situation is found

(1) *The Encyclopedia Americana,* 1925, Vol. XXIV, p. 725.

to be radically different. In population, wealth, in every branch of production, in finance and in other facilities, and in actual volume of foreign trade, the disproportion between the Canadian and United States sides of the tributary area is so marked that it constitutes a serious factor and one that must be constantly borne in mind.

Within the last thirty years a radical change has taken place in the railway situation in Canada. Previous to the building of the second and third trans-continental lines the commercial needs of the country were reasonably met by the existing railways. Since 1903, however, a big expansion in railway improvements and facilities has set in; due, no doubt, to the natural optimism of a vigorous, growing and ambitious people. In time, of course, the Dominion will need all the railway facilities available, but the present situation is that railway building has outstripped population and production. The remedy for what may be termed "development in advance of requirements" is increased population, and then will come increased tonnage of commodities for movement by the railways, together with greater passenger, express and other revenues. Canada will secure this increase in course of time through settlers who will occupy the available land in the west.

The region in Canada tributary to the proposed waterway consists of two distinct areas of productive land separated by a long narrow stretch of undeveloped country, one end being the eastern and central portions of the Province of Ontario, sometimes called Old Ontario, and the other the prairie provinces of Manitoba, Saskatchewan and Alberta, together with a narrow tract of sparsely populated country north of Lakes Huron and Superior. The total population of the whole area is about 4,750,000.

This region contains natural resources in timber, minerals and virgin land of great value and extent, but the number of people in proportion to its area is small. The compactness and uniform productiveness of the United States tributary area are lacking in the Canadian area. The population of the latter is about one-tenth that of the former. Its resources, as a whole, are rich and varied, but its production falls far below that of the United States area, particularly as regards manufactures. Except in grain, it has nothing approaching the same quantity of products to fill the holds of vessels sailing from Great Lakes ports to overseas ports, and it offers only a comparatively small market for return cargoes. Far from its population and industrial development having outrun its transportation facilities, the fact is that the railways of Canada are considerably ahead of the requirements of the country.

The population of the United States area tributary to the St. Lawrence Waterway is approximately 42,000,000, and a considerable portion of this mass of people is engaged in the important manufacturing industries which have come about through the proximity of basic raw materials and unrivalled agricultural resources. The territory embraces all or large portions of the States of Ohio, Indiana, Kentucky, Illinois, Iowa, Missouri, Kansas, Nebraska, North and South Dakota, Montana, Wisconsin, Minnesota, Michigan, Pennsylvania and New York. These states form an immense irregular parallelogram, with one end resting on the Rocky Mountains, and the other embracing the greater part of the coast line of the Great Lakes with most of their harbors.

The area contains an industrious, progressive and ambitious people, and the phenomenal growth of such cities as Chicago

and Milwaukee, Detroit, Buffalo, Cleveland and Toledo, Duluth, Minneapolis and St. Paul, Omaha and Denver, is in itself a sufficient indication of the extent to which this region has been favored by Nature. Its resources are varied and large in extent, and the region is particularly rich in the raw materials of the basic industries. Its soil, comparatively little of which is barren, produces a considerable proportion of the national harvest of the important grain and root crops, and it feeds millions of cattle, hogs and sheep.

In spite of its great production records of years past, this territory still contains immense resources in iron ore, copper, coal and timber. It is not only self-supporting in the way that it feeds its own population, but it produces substantial surpluses for export to home and foreign markets. It is at one and the same time the largest producing area of the United States, and a large consumer of raw materials and manufactured articles from abroad.

The middle-west and western states are equipped in every way to take full advantage of the transportation facilities held out to them by the proposed deep waterway for the development of their trade, both with the Atlantic and Pacific seaboards of the United States, and with countries overseas. And, further, they are almost compelled to seek this new outlet to the sea by reason of the fact that the existing transportation agencies have for some years past found it exceedingly difficult to handle the situation.

It has become essential to the future prosperity of the American nation that means be provided for placing the surplus products of the great interior section of the country contiguous to the Great Lakes in foreign markets at low cost. The present rail haul of 1,000 to 1,500 miles, with the at-

A section of the water front at Detroit

tendant cost and delay of transfer at Atlantic ports, is a handicap to the foreign trade of the United States, and limits, consequently, that country's ability to meet competition abroad.

Railways in the United States are inadequate to handle the vast amount of traffic involved; more cars mean more confusion. America's real need is more routes, more outlets and better terminals. The cost of getting freight through the terminals on the Atlantic coast frequently equals the cost of the rail haul from parts as far west as Chicago. More and better terminal facilities are urgently needed, but of still greater importance to United States commerce is the opening of a waterway to the heart of the country to eliminate a large proportion of the transfers.

When comparing the characteristics of the Canadian and United States sections of their respective tributary areas, and their ability to make use of the suggested deep waterway, a point that should not be forgotten is the unique advantage enjoyed by the United States in the possession of Lake Michigan, which runs far down into the heart of her territory. The extensive coast line of the lake, with its numerous harbors each linked up with the network of railways which covers the middle-west, places the surrounding territory in a favorable position to take advantage of the transportation facilities offered by the deep waterway.

It should also be borne in mind that the ports of Lake Michigan have a decided advantage over those of Lake Superior, by reason of the fact that when a deep draft vessel has entered Lake Huron, it can pass into Lake Michigan without the necessity of navigating the channels of the St. Mary's River and the locks at Sault Ste. Marie. A second important

point to remember is that, as between the Canadian and American sides of the tributary area, the latter contributes much the larger share of the foreign and coastwise trade, and in all probability will continue to do so for many years to come. The benefits to be derived from the opening of the proposed water route to the sea, therefore, would accrue in greater measure to American than to Canadian interests, though it is reasonable to assume that eventually the advantages would be more evenly distributed.

To sum up, it may be said that the difference in the position of the transportation facilities in Canada and in the United States, is that in the former country railway facilities are in advance of the requirements of the country, while in the latter, at least so far as the area economically tributary to the proposed waterway is concerned, population and production have outstripped railway facilities. In America the means of transportation between the tributary area and the seaboard are altogether inadequate because the railways have been unable to keep pace with the needs of the country. In Canada railway development is still in advance of population and production.

Experience has demonstrated not only the great importance of water communication to the foreign commerce of any country, but also the equally great advantages of linking up rail and water routes. It is beyond question that the industrial development of Great Britain in modern times has been due largely to her ready access to the sea. Britain has no resources of iron, yet she has built up great steel industries; she grows no cotton, yet she supplies half the world with cotton goods; she produces little wool, yet her woollen mills have developed into a great industry. Her merchant marine

sail the oceans of the world, bringing to her shores the raw materials she needs for her industries, and carrying back the finished products. The sea, that most efficient, adaptable, far-reaching, economical of thoroughfares, possessing all the advantages of land transportation, with few of its disadvantages, has made Great Britain prosperous.

And, what water transportation has done for Great Britain it has done in a greater or lesser degree for other nations in other times. Access to the sea gave the diminutive republic of Venice pre-eminence in the Mediterranean. It transformed little Holland from a comparatively obscure province into a great maritime nation. It gave to Spain her period of greatness. It brought Germany before the war within almost measurable distance of supremacy in the foreign trade of the world.

The conclusion is obvious that, if countries that had for the most part to import their raw materials from abroad were able to build up a great foreign trade because of their ready access to the sea, the region economically tributary to the Great Lakes, with its limitless resources, its raw materials within easy reach, its facilities for industrial expansion, can hardly fail to become an even greater factor in the world's markets than it is to-day, if given a practicable and efficient water route to the sea.

Of scarcely less importance is the linking up of land and water routes. Here also the experience of Europe is illuminating. Belgium and England are the most densely populated regions of Europe and both are pre-eminently industrial nations. Each possesses a network of railways extending into every corner of the country, yet each is to-day, despite its short rail haul to tidewater, finding it necessary in order

to give adequate service to congested areas, to link up the railways and the highways with the inland waterways. Despite the difference in area between these countries and the region tributary to the Great Lakes, transportation conditions are not altogether dissimilar, particularly in the more congested areas of the middle-west. In such a district as that around the south shore of Lake Michigan, is to be found much the same condition of a rapidly increasing concentration of population and industry, with a corresponding overcrowding of railway lines, that is so noticeable in England and Belgium. Moreover, similar conditions are quite evidently developing in the territory immediately tributary to Detroit, Cleveland and other middle-western cities.

If these cities and their tributary territory are given access to the sea by a deepened St. Lawrence River they will find it necessary, in order to secure the maximum benefits from the new route, to co-ordinate their railways and highways with the great waterway that will be common to them all. The advantages of co-operation will undoubtedly be found as real in this case as in Europe.

An example on the North American continent of the effective co-ordination of rail and water services is found in the Canadian Pacific Railway which, in conjunction with its railway system extending from ocean to ocean, maintains lines of steamers, not only on the Atlantic and Pacific Oceans, but also on the Great Lakes and on the inland waters of British Columbia.(1)

No study of the questions of transportation and communication can be complete unless some consideration be

(1) *Report of the International Joint Commission,* p. 103, 104, 136, 137, 156, 157, 177, 178.

given to the important adjunct of artificial waterways. The canals of Canada and the United States are a necessary complement to the whole system of transportation, and in Chapter VI will be found brief particulars of the canals of both countries that may be rightly considered to have a bearing upon the project of the St. Lawrence Waterway.

Chapter III

THE INTERNATIONAL ASPECT OF ARTERIAL WATERWAYS

He who decides a case without hearing the other side though he decided justly cannot be considered just.—Seneca.

Chapter III [1]

In arranging the material for a comprehensive study or survey of the question of arterial waterways in their international aspect, it will be found that the subject divides itself almost naturally into three main heads:

(1) Waterways in the early ages of civilization;
(2) Their position prior to the Congress of Vienna, 1815;
(3) The changes that have taken place between 1815 and the present time.

In considering the subject in its broadest aspect, one fact becomes apparent almost at the outset, namely, that the progress shown by the gradual recognition of the importance of arterial waterways reflects the advance of civilization which, in turn, is demonstrated by the history of nations generally. As civilization has moved forward so the nations of the world have conducted their affairs on correspondingly enlightened methods which, in their turn, have been applied to the development of their natural resources. Thus, it is possible to look back at the panorama of history. In the early ages nations were driving one another off the face of the waters by force of arms; but to-day the flags of all countries fly peacefully side by side on the oceans of the world and their tributary waters.

WATERWAYS IN THE EARLY AGES

The importance of freedom of navigation arises principally from the fact that the sea and its connecting waters are the only continuous highways of the world. "By the law of nature, then," says Justinian, "the following things are com-

(1) P. M. Ogilvie, *International Waterways;* Preface and pages 5 to 158.

mon to all men; air, running water, the sea, and consequently the shores of the sea." This passage occurs in the *Institutes of Justinian,* and it is the first instance in Roman law where the freedom of the seas is declared common to all nations.

In his *History of the Greek World,* Herodotus explains that the sea is a road that unites the peoples of the earth to each other and that those who dwell inland are shut off from the facilities and attractions of human intercourse and unacquainted, therefore, with the progressive growth of the race. It is hardly necessary to explain that the seclusion referred to by Herodotus has, during the course of time, gradually disappeared. The introduction of railroad transportation, steam navigation and the freedom of navigation on inland waterways, have brought about by degrees a condition whereby those who live on the shores of internationalized waterways are, to all intents and purposes, just as advantageously situated as though they were on the sea coast.

Throughout the ages, the efforts made to gain control of navigable waters have been carried on with varying degrees of intensity. So far as can be traced, the struggle commenced originally along the courses of important inland waterways, notably in the valleys of the Tigris and the Euphrates, as well as on the Nile and throughout the course of the Danube from the Alps to the Euxine.

Co-incident with this struggle, and with the increase in the use to which waterways were being put, came the necessity for an adequate code of maritime law, and those nations which had specially laid themselves out to develop commerce on the high seas, and on inland waterways, were the first to realize its importance. In fact, the navigation laws of Babylon recognized that the Euphrates constituted a water-

way within this category for, as a great highway carrying the trade of oriental nations, its standing was tantamount to that of the sea.

In northern Europe, the conquests of Charlemagne provided almost unlimited opportunities for commercial development and expansion. To facilitate communication between the various provinces of the Occidental Empire, and to meet the demands of the increasing volume of inland traffic, extensive operations were undertaken to improve the waterways of his realm. In addition, it was the endeavor of Charlemagne to extend the commercial interests of his subjects by inducing them to open up trade relationships with countries overseas.

As part of this policy, the construction of a canal was undertaken with the object of connecting the Rhine and the Danube Rivers in the hope that it would encourage trade with Asia Minor and the countries bordering on the Euxine. Unfortunately, the Norman invasions during the latter years of Charlemagne's reign put an end to this project and so prevented the completion of his plans for the commercial expansion of the realm.

A further example in history of the recognition of inland waterways as a necessary adjunct to commercial expansion is provided subsequent to the incorporation of Portugal by Spain in 1581. The former kingdom was the pre-eminent power of the New Age; she held dominion over the seas as a result of the exploits of her intrepid mariners who were the first men of the Christian era to sail beyond the equator.

The contribution by Portugal of her large naval forces to Spain's already formidable sea power brought prestige and

almost unlimited command of the sea, culminating in the reign of Charles V, King of Spain, Emperor of Germany and sovereign in claim of the entire western hemisphere. This monarch, in his efforts to exalt still further the power of Spain, conceived the idea of cutting a canal across the American isthmus to unite the Atlantic with the Pacific Ocean. This canal was intended to facilitate trade between Spain, Peru and the Philippines, but the lack of capital sufficient to carry the project to a successful conclusion led to its abandonment.

THE POSITION PRIOR TO THE CONGRESS OF VIENNA, 1815

Britain's sovereignty of the seas, which she had gained, asserted and maintained, and ultimately secured with the destruction of Napoleon's sea power, was destined to prove an embarrassment instead of a help to the advancement of her national development and enterprise. A radically changed situation in maritime affairs threatened her future security as a nation, although the battles of the Nile, St. Vincent, Toulon, Ushant, Camperdown, Copenhagen, and Nelson's decisive victory at Trafalgar, by annihilating the navies of Europe, had assured the continued enforcement of her undisputed dominion as mistress of the seas.

At a time, therefore, when Britain might have "ruled the waves" more inflexibly than ever before, she voluntarily abandoned her sovereignty. This renunciation of her long cherished dominion was the means of bringing about the final recognition by the maritime powers of Europe that the high seas, constituting as they do the great highways of commerce and communication between civilized nations and the remotest regions of the earth, should remain unrestricted during the continuance of peace for the enjoyment and use of every nation.

Having presented the freedom of the seas to the powers of the world, and recognized its principle in such a wholehearted way, Britain's maritime policy was henceforth conducted in an exemplary and generous manner. Her own national requirements demanded the acceptance and the application of this principle of freedom to its fullest extent for the reason that, owing to the continued development of her maritime interests, it was essential that British vessels should sail the seas and their tributary waters without suffering burdensome restrictions.

In her subsequent efforts to secure greater opportunities for her rapidly growing maritime enterprises, Britain next sought the freedom of navigation on the great arterial rivers —waterways navigable through several states—and she achieved noteworthy success in the internationalization of such arterial waterways as the Paraguay, the Danube, the Amazon, the Rio de la Plata, and other extensive inland waterways throughout the world.

At the beginning of the nineteenth century Britain's dominion of the seas, as previously pointed out, terminated in the universal recognition of the principle of freedom. All nations realized and appreciated the incalculable benefits to be derived by the ending of a state of affairs that had existed for so long, and this realization had the effect of creating an energetic spirit of co-operation among the principal countries of Europe to extend still further the opportunities for commercial intercourse with all the world through the establishment of a similar freedom of navigation on inland waterways.

Montesquieu states in his *Spirit of Laws* that the history of commerce is that of the communication of peoples. It may be added, moreover, that by means of universal commerce

over the waterways of the world, the former isolation of the various races, because of their geographical positions, ceased to exist.

THE CONGRESS OF VIENNA TO THE PRESENT TIME

Such, then, was the spirit pervading Europe at the time of the Peace of Paris in 1814. The Congress of Nations, held at Vienna in the following year, advanced matters a step further by proclaiming that henceforth the great inland waterways of Europe, separating and traversing several states, should be open freely to the navigation of vessels from any country whatsoever. Hitherto, freedom of navigation had been concerned solely with the open sea, but this declaration accorded an extension of the principle, which was destined to bring increasing benefits as it received a wider application, during the succeeding years. Maritime nations showed their readiness to accept the new agreement that the sea belongs to all and, furthermore, that in the interest of international economy, the commercial navigation of arterial inland waterways should be on terms identical with those governing the high seas.

In looking back over the one hundred and fourteen years that have elapsed since the Congress of Nations met at Vienna, it is clear that, as a result of the epoch-making declaration, the maritime powers of the world enjoy an extended field of enterprise owing to the fact that international waterways render easy access to the interiors of continents, thus affording passage to ocean vessels in certain instances for almost three thousand miles inland.

The saving that accrues to society where the right of navigating inland waterways is accorded to foreign ships, permitting the continuance of the voyage to distant river or lake

ports, is equally clear. Such an opportunity to effect substantial savings in the movement of goods is of vital importance. Society requires the interchange of an ever-increasing volume of commerce, and for this reason the perfection and amplification of means of access to various and remote regions of the world become constantly more imperative.

"As a highway, a railroad competes in vain with a river; the greater speed cannot compensate for the smaller carriage. Water traffic for equal distances is much cheaper, being more facile and more copious, and therefore more useful in general." So says Admiral Mahan in his book, *Problems of Asia.* There are certain physical peculiarities, too, which accord to water transportation advantages not enjoyed by land carriage. The fundamental difference exists in the fact that the ocean is a highway, as are all navigable waters, over which a given load may be moved with considerably less expenditure of force than is required by the simplest of all forms of land carriage, namely, railway transportation.

The Congress of Vienna in 1815 exhibited by its declaration a full appreciation of the more enlightened policies which were destined to govern commercial and maritime relations during the nineteenth century. The declaration portended enhanced opportunities and benefits to all commercial nations by the assurance of extended facilities for transportation over the waterways of the world. Forthwith, all inland waterways separating or traversing several states were susceptible of internationalization throughout their entire navigable course, subject only to the police power of the riverain states. Foreign vessels engaged in commercial navigation on inland waterways thenceforth were assured rights equal to those enjoyed by the vessels of riverain states.

The work of the Vienna Congress was endorsed and amplified by the Allied and Associated Powers at the Peace Conference at Paris. By providing for the international navigation of certain European waterways in the treaties with Austria, Germany and Poland, this body evinced a still more enlightened appreciation of the benefits to be derived by all nations from securing the greatest possible facilities for intercommunication.

A natural corollary to the universal navigation of inland waterways as an international concern is the desire that is being constantly and increasingly shown for the still further improvement and development of arterial water highways in the interests of commerce. The march of progress which has brought with it an ever-increasing use of such channels now calls for even greater facilities.

The invention of various mechanical appliances to improve navigation; dredging machinery, hydro-electric locks, the screw propeller, travelling cranes and hoists for the expeditious transhipment of cargoes, has disclosed further and unforeseen opportunities for inland navigation. With appropriate machinery, it is now possible so to improve waterways that they will permit of the employment of larger vessels for inland transit, and afford the means of water transportation to remoter districts than ever before.

No explanation is necessary of the manifold benefits to be gained by loading cargoes at the inland ports of one country and transporting them to points on distant continents without the necessity of transhipment. A vessel may load at New York, Montreal or Chicago, and may voyage continuously until arrival at her destination, whether this be nearly 3,000 miles up the Amazon at Iquitos; or at Matadi on the Congo;

or Asuncion, Paraguay, more than 1,000 miles inland on the Rio de la Plata; or Hankow on the Yangtse, 600 miles from the sea; or in Europe at one of the river ports of the Danube; and, in times of peace, no nation may in any way prohibit this right of unrestricted navigation.

This is a movement that will be carried still further, and all over the world to-day improvements to harbors and to inland waterways are being carried out in order to provide the increased facilities that progress demands. The Welland Canal forms a case in point; in Europe, the Danube below Braila and along the Sulina branch has been deepened and corrected, while by canalization and other works navigation has been shortened from forty-five to thirty-three miles. In the case of the Rhine, large sums are being spent every year on improvements, and the efforts of the authorities are being directed to the deepening of the navigable channel from the North Sea to Strassburg.

Other instances might be given of the changes that are taking place in the natural character of the international inland waterways throughout the world, but as the object of this volume is to tell the story of the St. Lawrence River with special reference to its future as an international highway, those who desire to pursue the subject of the international aspect of arterial waterways are referred to Mr. Ogilvie's standard work, *International Waterways,* and to the Bibliography at the end of this book, where further sources of information are indicated.

Port Dalhousie, showing ship congestion at head of old Welland Canal (October, 1928)

Official photograph, Department of the Interior, Ottawa

Chapter IV

THE ST. LAWRENCE WATERWAY PROJECT

"Two ways the rivers
Leap down to different seas, and as they roll
Grow deep and still, and their majestic presence
Becomes a benefaction to the towns
They visit, wandering silently among them,
Like patriarchs old among their shining tents."

—Longfellow, *The Golden Legend.*

To the St. Lawrence River—

"The first time, I beheld thee, beauteous stream,
How pure, how smooth, how broad thy bosom heaved,
What feelings rushed upon my heart—a gleam
As if another life, my kindling soul relieved."

—Maria Brooks.

Chapter IV [1]

"A RIVER that has no end," were the words used by the Indians to describe the St. Lawrence River to Jacques Cartier. Commissioned by the King of France to explore and trade on the American coast, Cartier sailed into the Straits of Belle Isle in the summer of 1534. His first attempt to find the entrance to the river failed, although he circled the whole Gulf of St. Lawrence, and it was not until his second voyage two years later that his quest proved successful. On the feast of St. Lawrence, August 10, 1536, he entered a bay on the north shore of the gulf, which he named "Baye Saint Laurens," and this name gradually was applied to the whole river, although Cartier himself always wrote of the "River of Canada." Early in September he reached "Canada," now Quebec, and on October 2, he arrived in Hochelaga, now Montreal.

Cartier established no permanent settlement, however, and it was left to Champlain to plant the flag of France on Canadian soil, in 1603 at Tadousac at the mouth of the Saguenay River, and in 1608 at Quebec. Between 1608 and 1616 Champlain explored the whole river system as far west as Lake Huron, reaching it by way of the Ottawa River, and taking possession of the country in the name of his King.

One of the most majestic rivers in the world, the St. Lawrence was to the Indians "the river that has no end." Well might they have thought so when it is borne in mind that the St. Lawrence system is over 2,000 miles in length including, of course, the Great Lakes, which are in reality

(1) *Report of Joint Board of Engineers on St. Lawrence Waterway Project* and *Report of the United States St. Lawrence Commission.*

but river beds of the Ice Age. If placed upon the map of Europe, the St. Lawrence River would extend from the port of Antwerp far into the east to the Ural Mountains, while in South Africa it would reach from Cape Town to Mozambique, taking in Port Elizabeth and Durban on its way. In the United States, it would flow from Cleveland, Ohio, to San Francisco, or from Spokane to New York. In South America, it would reach from Rio de Janiero to the Falkland Islands.

The importance to Canada of the St. Lawrence River as a trade route cannot be over-estimated. As a natural highway between all points west of the Maritime Provinces and Europe, it is unique in permitting ocean traffic to penetrate a thousand miles into the heart of the country.(1) Montreal its principal port, the second largest on the North American continent, is advantageously situated for overseas trade as the following table shows:

Comparative distances from the principal Atlantic ports to Liverpool:

Halifax	2,485	miles
Quebec	2,625	"
Saint John	2,747	"
MONTREAL	2,760	"
New York	3,073	"
Philadelphia	3,179	"
Boston	3,521	"
Portland	3,743	"
Baltimore	3,907	"
New Orleans	4,613	"
Galveston	5,496	"

(1) *Encyclopaedia Britannica,* 13th Edition, Vol. XXIV, p. 21.

THE WATERWAY PROJECT

In general terms, the St. Lawrence Waterway project is a scheme to connect the oceans of the world with the Great Lakes of North America, by means of a ship canal between Lake Ontario and Montreal of a depth sufficient to allow of the unrestricted passage of ocean-going vessels drawing up to 25 feet of water. Such a depth would admit 88 per cent. of all ships now entering North American ports. As will be seen, it is principally in the upper reaches of the St. Lawrence River that the hindrances to deep water navigation are to be found, and here the required depth would be obtained by damming the river and flooding out the rapids. The development of the waterway would necessarily also become a development of the hydro-electric power from the rapids which now obstruct navigation. The complete power development would provide a total of about 5,000,000 installed h.p. of electricity, of which about 2,250,000 would be generated in the upper rapids along the international section of the river between the Province of Ontario and the State of New York, the remainder lying in the lower rapids which are wholly within the Dominion of Canada.

This is the largest possible hydro-electric power development on the North American continent. It is contended by certain interests favorable to the project that the development of the river for power purposes would in itself cover the cost of construction of the shipway. Dams necessary for the generation of power would create a series of pools in place of the present rapids which, with the supplement of locks and short canals, would become the shipway.

Construction would require about eight years, although it may be safer to assume, ten years as a minimum period,

even if all international questions, necessary legislation and administrative and financial problems could be speedily arranged.

As regards the cost of the undertaking, various estimates have been put forward from time to time in connection with the different plans proposed, and these will be dealt with in their appropriate places as the work of unfolding the St. Lawrence Waterway project proceeds.

DESCRIPTION

The five Great Lakes of North America have an area of about 95,000 square miles and are the largest body of fresh water in the world. They constitute the source of the St. Lawrence River, and form with it a waterway system extending from the interior of the continent to the sea. The international boundary between Canada and the United States runs through the middle of all the lakes except Lake Michigan, which is wholly within American territory. Lake Superior, the uppermost and largest of the Great Lakes, discharges into Lake Huron through the rapids of St. Mary's Falls and the St. Mary's River. Lake Michigan is connected with Lake Huron by the wide and deep Straits of Mackinac, and Lake Huron discharges into Lake Erie through the St. Clair River, Lake St. Clair and the Detroit River. Lake Erie falls into Lake Ontario through the Niagara River.

From Lake Ontario, the St. Lawrence flows 533 miles north-east to Father Point, which marks its transition into the Gulf of St. Lawrence. The first 116 miles of the river, that is, from Kingston or Tibbetts Point to Cornwall and St. Regis, form the international boundary between Canada and the United States, and for the remainder of its course eastward the river runs entirely through Canadian territory.

The city of Montreal is 183 miles down stream from Lake Ontario.

The distances by the ordinary vessel routes from Duluth and Port Arthur at the head of Lake Superior to Kingston at the head of the St. Lawrence River proper are 1,160 miles and 1,038 miles respectively, while the distance from Chicago to the head of the St. Lawrence is 1,067 miles.

The fall at mean stages between Lake Superior and Lake Huron is 21 feet, but Lake Michigan and Lake Huron are at the same level. The fall from Lake Huron to Lake Erie averages 8.5 feet; while that from Lake Erie to Lake Ontario is 326 feet; of which approximately 165 feet are absorbed in the drop at Niagara Falls. The fall from Lake Ontario to Montreal averages 226 feet, and from Montreal to the sea about 20 feet, the latter being distributed through the 160 miles of river between Montreal and Quebec.

Navigation from Lake Superior to Lake Huron passes through the locks at St. Mary's Falls. Channels have been excavated through the St. Mary's River above and below the locks, and through the St. Clair River, Lake St. Clair and the Detroit River, to afford a minimum depth of 20 feet at the lake levels that have been adopted as the standard for improvements. The extreme low stages reached by the lakes during the last few years have been generally below these levels, with the result that the channel depths are less than 20 feet. In the latter part of the navigation season of 1925 the depth available was 18 feet, and at no time during that year did the maximum draft that could be carried from Lake Superior to Lake Erie exceed 19 feet.

The dredged channels between Lake Superior and Lake Erie aggregate nearly 100 miles in length. Their cost, for

capital account only, including the cost of the locks in the St. Mary's River, was as follows:

Expended by Canada to March 31, 1925	$ 5,560,009
Expended by the United States to June 30, 1926	44,721,319
Total	$50,281,328

Navigation from Lake Erie to Lake Ontario passes through the Welland Canal which was constructed and is operated by the Dominion Government. A vast improvement scheme in connection with this canal is now on the point of completion, and its history and development are dealt with in detail in Chapter VI.

Navigation on the St. Lawrence River from Lake Ontario to Montreal is provided by isolated channel improvements and a series of side canals round the rapids, also constructed and operated by the Canadian Government, which afford a depth of 14 feet. Detailed particulars of these canals will also be found in Chapter VI.

Navigation on the Great Lakes and the St. Lawrence River at the present time falls into three devisions.

(1) Lake navigation operating normally on 20 foot draft on and between all the lakes except Lake Ontario;

(2) Canal navigation operating normally on 14 foot draft between Lake Erie ports and Montreal through the Welland Canal, Lake Ontario, the St. Lawrence River and St. Lawrence canals.

The completion of the new Welland Canal will open Lake Ontario to deep lake navigation which will then be separated from ocean navigation by the 183 miles of the St. Lawrence River above Montreal.

Lake commerce at present amounts to upwards of 90,-

000,000 tons a year. The bulk cargoes, principally iron ore, coal and grain, are moved in a special class of vessel developed for that purpose. They are of great length in proportion to their draft, and are so designed that they can be loaded and unloaded rapidly by special machinery installed for that purpose at terminal ports. The present commerce through the Welland Canal and the St. Lawrence canals is carried by smaller vessels of similar design which are relatively high powered to meet the swifter currents of the river. This commerce has been increasing rapidly in recent years, and nearly all the water-borne grain that passes through Montreal is transported by this route.

The St. Lawrence Waterway project itself concerns only that part of the river that lies between Lake Ontario and Montreal, but it vitally affects all inland navigation and entails the deepening of all lake harbors and inter-lake channels, together with the provision of such terminal equipment as may be required. Eastward from Lake Ontario the water runs in deep, slow-flowing reaches and lake-like expansions, easily improvable for navigation, with intervening rapids and swift currents. For the first 67 miles from Lake Ontario the river is a deep, placid stream, while it passes through the remaining 49 miles of the international border in a succession of rapids and swift currents. Leaving the border, the river expands into the quiet waters of Lake St. Francis; from this lake it drops in a succession of rapids to Lake St. Louis, and from Lake St. Louis through more rapids to Montreal.

SUGGESTIONS OF THE INTERNATIONAL JOINT COMMISSION

Such is the picture of the Great Lakes-St. Lawrence system as it exists to-day and such is the "raw material" on which the engineers, contractors, financial authorities and

other experts, representing the Governments of Canada and the United States, have to work in drawing their plans for providing navigation for ocean-going vessels and for securing the greatest use of the water for power.

The first investigation as to ways and means for bringing the St. Lawrence Waterway project into effect was undertaken during the years 1920 and 1921 by the International Joint Commission, a body created by the Boundary Waters Treaty made in 1909 between Great Britain and the United States. How this commission proposed to transform the river with the object of bringing about the desired results is explained in its findings. Briefly, these were:

(1) The physical conditions on the St. Lawrence are favorable for improvements for navigation which will be permanent and will have low upkeep costs;

(2) Improvement of the entire reach from Lake Ontario to Montreal for navigation alone is feasible but the loss of the power that can be generated as a by-product in some reaches is not warranted;

(3) The development of nearly all the potential power in the river, amounting to approximately 4,100,000 h.p., can be made as co-ordinate parts of schemes for the improvement of navigation;

(4) The simultaneous development of such a vast quantity of power is not a sound economic procedure as a market to take this output is not in existence and cannot be expected to spring into being at once;

(5) The sound method of procedure is to improve for navigation along those reaches where side canals and locks can most economically be used and where the development of the power at some future time is not interfered with by the proposed improvements, and in that part of the river where the construction of locks and dams offers the most feasible means of improving navigation to provide for the development of the incidental power obtainable as a result of the heads created by the dams;

(6) The improvements undertaken afford a navigation channel 25 feet in depth, with lock sills 30 feet in depth, so built as to permit of the eventual enlargement of the channel to that depth;

(7) The improvement be secured by the combined development for navigation and for power of the rapids section on the international boundary, side canals round the other rapids sections, and the necessary channel excavation elsewhere.

The estimated cost of the entire work to provide a 25 foot channel and to develop 1,464,000 h.p. was as follows:

First division. Side canal from Montreal harbor to deep water in Lake St. Louis	$55,783,000
Second division. Side canal from deep water in Lake St. Louis to deep water in Lake St. Francis	36,590,000
Third division. Channel dredging in Lake St. Francis	1,158,000
Fourth division. Combined navigation and power development in international section, with annual power output of 1,464,000 h.p. (total installed capacity approximately 1,850,000 h.p.)	159,097,200
Fifth division. Navigation improvement above rapids section	100,000
	$252,728,200

The estimated extra cost of increasing the navigable depth throughout the entire stretch to 30 feet at a later date was $17,986,180. The report considered but did not recommend plans for power development in the first and second divisions.

Of the total estimated cost of the project, $159,097,200 was for the combined navigation and power development in the international section of the river. A head of 74 feet was to be developed by a dam across the river at the Long Sault Rapids. A second dam was to be constructed 23 miles upstream at Ogden Island, to provide navigation through the upper rapids of the reach, afford control over the flow of the river, and ensure suitable winter operation. The head of approximately eight feet available at this dam in summer was not to be developed. The main dam and related structures were, however, to be so designed that they could be raised subsequently so as to utilize fully whatever head the operation of the works might show to be economically practicable.

The report pointed out that the construction of the upper dam proposed at Ogden Island, and the enlargement of the discharge capacity of the upper reaches of the river, would afford control over the level of Lake Ontario and the flow in the St. Lawrence River. This control could be so exercised as to raise the mean level of the lake without causing it to fluctuate beyond the limits previously reached. The studies made did not show, however, that any great increase in the natural low water flow could be made for the benefit of either power or navigation in Montreal harbor or in the ship channel below.

The Canadian and United States engineers attached to the commission joined in all the recommendations contained in the report, except as to the programme of regulation of the levels and outflow from Lake Ontario which should be put into effect after the project was completed, each submitting a programme regarded as being most suitable to that end. The essential difference between the two was that the proposals by the Canadian engineer provided for a greater restriction of the winter flow, with a view to creating more desirable ice conditions. With this restriction it was not possible to secure quite as favorable results from regulation as would be afforded by the scheme proposed by the United States engineer.

RECOMMENDATIONS OF THE JOINT ENGINEERING BOARD

No practical use was made of the plans and recommendations of the International Joint Commission for bringing about a deepened waterway which would allow ocean-going ships to proceed from the Atlantic Ocean up into the Great Lakes and for harnessing the latent power of the St. Lawrence River. The Department of Railways and Canals of

the Dominion, having available the data collected for the report of the commission, continued investigations on the river through the years 1922 and 1923, and until the appointment of a Joint Engineering Board in the spring of 1924. This board came into being as the result of a recommendation by the International Joint Commission that before a final decision be taken with regard to its findings an enlarged board should be appointed, and that a further investigation of the whole subject should be made.(1)

This Joint Engineering Board was composed of three Canadian and three United States engineers, and its investigations were carried out with thoroughness and with as much expedition as the magnitude of the work allowed. Its report was published in November, 1926, and in it the river was divided into five sections. Downstream these were:

(1) The Thousand Islands section, embracing the deep, lake-like reaches of the river, 67 miles in length, from Lake Ontario to the first swift water at Chimney Point, three miles downstream from Ogdensburg and Prescott;

(2) The International Rapids section, embracing the 48 miles of rapids and swift water between Chimney Point and the head of Lake St. Francis;

(3) The Lake St. Francis section, extending for 26 miles through the lake to the end of deep water at its foot;

(4) The Soulanges section, embracing the 18 miles of rapids and shoal water from Lake St. Francis to Lake St. Louis;

(5) The Lachine section, embracing Lake St. Louis and the rapids and shoals from this lake to Montreal harbor, a length of 26 miles.

The first two sections lie along the international boundary between the Province of Ontario and the State of New York. The remaining three are in the Province of Quebec. The improvement of the Thousand Islands section and of the Lake St. Francis section is solely a question of excavating channels

(1) *Report of the International Joint Commission.* p. 180.

for navigation, but the other three sections can be improved for power in addition to navigation.

The plans of the Joint Engineering Board were prepared in accordance with the recognized principle that the interests of navigation on the St. Lawrence River are paramount. A full observance of this principle does not interfere with the beneficial use of the flow of the river for power generation; on the contrary, the improvement of the rapids sections of the river for the joint benefit of navigation and power affords, as a rule, better navigation than could be secured by the improvement economically justifiable in the interest of navigation alone.

The schemes presented by the Joint Engineering Board were designed to provide to the best advantage for the development of the capacities and possibilities of the waterway. The magnitude of the interests in the two countries that would be affected by the improvement if the project were carried out were fully considered. The board kept in view the fullest ultimate development of the navigable capacity of the waterway commensurate with its cost. An endeavor was made to provide the maximum amount of open river navigation with a minimum of locks and canals. For the initial improvement it adopted the minimum standards mentioned later, but the plans were so drawn that the navigation improvements could be enlarged at the least economic loss as the traffic justified further improvement. Plans that would restrict the best eventual development of the waterway for navigation were, therefore, discarded.

The estimates submitted by the Joint Engineering Board were based on navigation channels 25 feet in depth and the sills of all locks and fixed structures were placed at 30 feet

depth to permit of the future enlargement of the waterway. The board gave careful consideration to the question as to whether it would be advantageous to provide initially for a channel depth other than 25 feet, and two of the three Canadian engineers favored excavation to a depth of 27 feet. On the other hand, two of the American engineers regarded the depth of 25 feet as being sufficient initially for the reason that a project for a greater depth through the inter-lake channels above Lake Erie is not foreseen for a long time.

To remove any confusion between the depth of the channels and the draft of the boats that can use them, the board pointed out that, owing to the difference in buoyancy, channels 25 feet in depth are suitable for safe and convenient navigation by vessels of not exceeding 23 feet salt water draft, and channels 27 feet in depth by vessels of 25 feet salt water draft. For boats of this size fresh water draft exceeds salt water draft by six to seven inches.

The board recommended and adopted standards for navigation improvements; thus, channels for navigation have a minimum width of 450 feet, except in canal sections where they have a bottom width of 200 feet at 25 foot depth. Open channels are widened where advisable on account of cross currents and at bends, and are both widened and deepened as required to afford suitable current velocities for navigation.

The locks conform in dimensions with those in the new Welland Canal, their chambers being 766 to 859 feet in length. Their clear width is 80 feet, with a depth over the sills of 30 feet. Duplicate sets of gates are provided so that two gates may always be closed against the upper level. Fenders afford an additional safety precaution, and guard gates, or emergency dams, are provided where necessary to

afford a means for stopping the flow that would result from the accidental destruction of any lock gates. The plans are so drawn that all locks can be duplicated as commerce requires additional facilities, and the estimates include the foundations for duplicating all flight locks, since these have less ultimate traffic capacity than single locks.

The 25 foot waterway as designed by the Joint Engineering Board has an estimated traffic capacity of 24,000,000 tons per annum after any flight locks included in the adopted plans have been duplicated. Flight locks are included in alternative plans for the improvement of the Soulanges section only. With these alternative plans the initial capacity of the waterway would be 16,000,000 tons per annum until the duplicate locks of the flight were completed, after which the traffic capacity would be 24,000,000 tons, established by the capacity of the separate lock of the system having the highest lift.

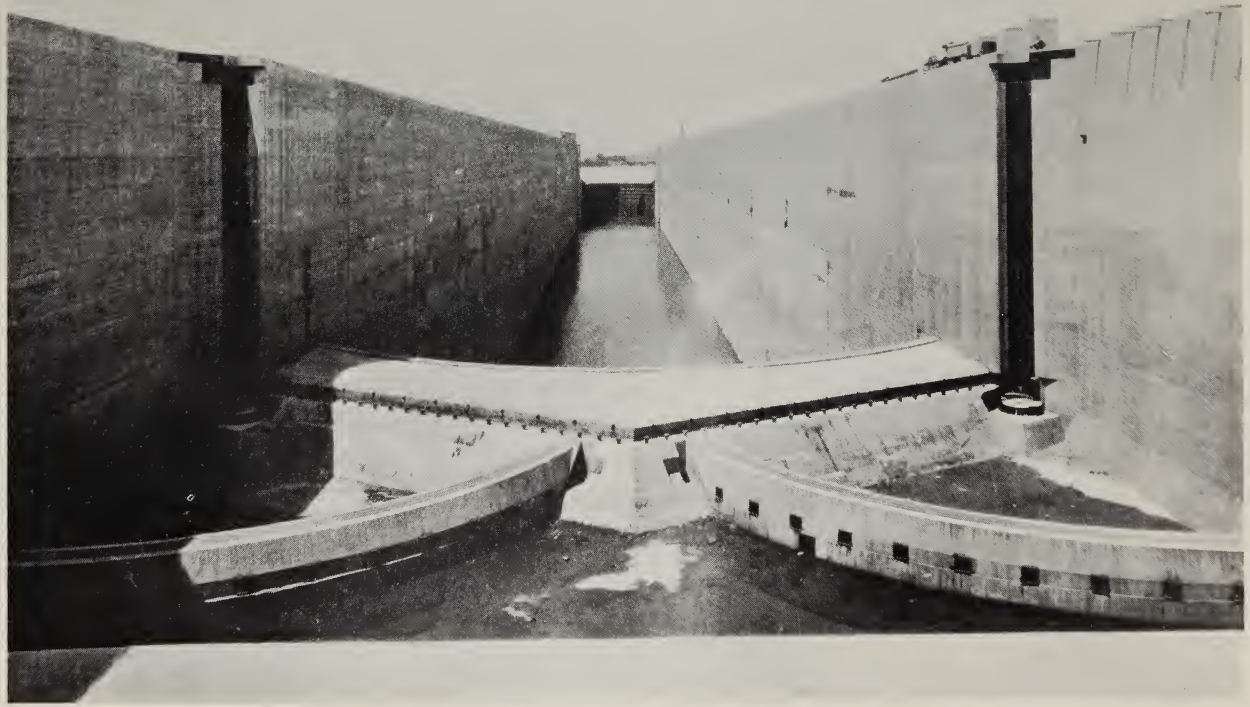
POWER INSTALLATIONS

The plans provide for an initial construction of power plans based on conservative estimates of the rate at which power can be marketed under restrictions as to export. The demand for power the world over is growing rapidly and the great potentialities of the St. Lawrence River may well become an important factor in the economic welfare of both Canada and the United States. The board, therefore, drew its plans with a special view to the eventual utilization of the complete power resources of the river. The various power houses have the capacity for the development of the maximum flow which the board considers as utilizable in the future.

The interests of navigation require that the flow down the St. Lawrence be maintained at a high degree of uniformity so as to prevent the maximum use of water for power by varying the hourly flow to meet the power demand. An installed capacity well in excess of the minimum flow of the river has been provided, however, since the increasing value of power will justify its eventual development from the flow available during high water periods only.

The ultimate installation proposed by the board in the international rapids section is somewhat less than the installation proposed by some of the applicants for authority to develop power in this section. The excess installed capacity provided in the plans of these applicants would afford little return on account of the limits inherent in the regulation of flow required in the interests of navigation and of power downstream. The initial installation of power machinery in each power house depends upon the market available when the works are put in operation. For purposes of estimating the expenditures required the initial installation is taken at 50 per cent. of the eventual capacity of the power houses first constructed.

A full study was given to the winter operation of power plants. The fundamental problem was found to be the maintenance of the winter discharge capacity of the river without excessive loss of head from gorging with ice rather than the local problems of handling the ice at the power plants themselves. The power sections of the river have so rapid a current that, practically without exception, they run open throughout the winter. From the time that the water reaches freezing point, in late December or early in January, until the end of the winter, these exposed reaches are continuously



Giant lock, new Welland Ship Canal

Official photograph, Department of the Interior, Ottawa

losing heat and making ice in the form of "frazil" and "anchor" ice.

"Frazil" is the term applied to the particles of ice forming in water where the current prevents the formation of a surface ice sheet. These particles agglomerate in pans of soft snow-like ice which float down the surface of the water. "Anchor" ice is the ice forming on the bed of the river due to the loss of heat by radiation. It rises to the surface when loosened by the heat of the sun and floats downstream in masses resembling frazil ice. The term "slush ice" is often applied to both. The masses of slush ice are carried down by the current and pack under and against the ice sheet formed over the quiet water at the foot of the reach, choking the channels to such an extent that rises in the water level of from 10 to 30 feet occur in winter at the foot of each open section.

The construction of a dam in any of the power sections for the dual purpose of concentrating head for power development and of improving the river for navigation would, in the majority of cases, create a deep, slow-flowing pool, certain to freeze over early in winter. The situation to be guarded against is the throttling of the river by the gorging of the channel at the upper end of this frozen pool.

It was established by the board from measurements of the loss of heat from the river, and confirmed by measurements of the ice actually formed that, with the temperatures ruling in the region, from 15 to 20 cubic feet of ice would be made in the course of a severe winter for every square foot of open water. It was found, however, that in all cases where the current velocity was as low as 2.25 feet per second, the frazil and anchor ice consolidates on the surface when

it meets an ice sheet, and extends this sheet upstream without the excessive gorging and throttling of the river that occur at higher current velocities.

The plans for power development are, therefore, based on enlarging the upper reaches of the power sections by excavation where necessary to ensure, with the discharges that must be maintained in winter, current velocities not exceeding 2.25 feet per second, except through short distances at the upper ends of the power reaches where the remaining area of open water could not produce enough ice to be of serious consequence. Such ice as may be formed in these short distances would be stowed in adjoining enlargements of the river below. With an ice sheet extending down to the intakes of the power houses the operation of the plants would be nearly, if not entirely, free from ice difficulties.

In such an extensive project as that for the development of the St. Lawrence River, it is not possible, even in the time occupied by the Joint Engineering Board in its investigations, to arrive at the best possible complete plans of the project, both for navigation and for power. The estimates are based on safe and adequate structures and channels, but the board expected that the responsible authorities in charge of the construction would exercise the usual latitude in making such alterations as might be found desirable in consequence of more detailed studies and the advancement of science.

DETAILED RECOMMENDATIONS

Thousand Islands Section.—This section, 67 miles in length, extends from Tibbetts Point, taken as marking the end of Lake Ontario, to Chimney Point, three miles downstream from the towns of Ogdensburg, N.Y., and Prescott, Ont. The river is generally broad, deep and slow-flowing,

with a total fall at mean stage of only about one foot. Between Clayton, N.Y., and Brockville, Ont., a number of granite reefs endanger navigation and the narrow, deep channels through the Thousand Islands and the Brockville group require some straightening for safe and convenient navigation by deep draft vessels. The improvement proposed is the removal of 12 reefs and the cutting back of four projecting points, all to a depth of 25 feet. The cost of this work is $1,000,000, and it follows the same lines as that proposed by the International Joint Commission, but the cost is greater as a result of the more accurate data secured since 1921.

International Rapids Section.—This section extends from Chimney Point to Colquhoun Island, opposite St. Regis, at the head of Lake St. Francis, a distance of 48 miles. The river here runs in a succession of rapids, beginning with the Galop Rapids, near the head of the section, and ending with the Long Sault Rapids, with the Rapide Plat, just above Morrisburg, about midway between. Swift currents predominate in the reaches between the rapids and extend to the middle of Cornwall Island. The total fall through the section at mean river stage is 92 feet, of which approximately one-third occurs in the first 18 miles above the foot of the Rapide Plat at Ogden Island, and the remaining two-thirds below that point. The present 14 foot navigation on the river is carried round the rapids by a series of side canals along the Canadian shore.

The improvement proposed by the International Joint Commission was the construction of a dam in the Long Sault Rapids which would raise the water level and create a pool reaching into the Rapide Plat at Ogden Island. Here a sec-

ond dam with a lock was to be constructed which, with suitable channel enlargements, would carry navigation through the upper part of the section. A canal along the Canadian shore, eight miles in length with two locks, was to carry navigation from the pool formed by the lower dam back to the river at the town of Cornwall.

The plan included the development of power at a Canadian and an American power house, situated at the foot of Barnhart Island, with a head of 74 feet and a total installed capacity of 1,777,360 h.p. In addition, a second power plant with a capacity of approximately 60,000 h.p., placed near the head of Long Sault Island, was to develop the surplus head of 29 feet created in the diversion which feeds the power plant of the St. Lawrence River Power Company at Massena, N.Y. The head available at the upper dam at Ogden Island, amounting to about eight feet during the ice free months, was not to be developed for power. It was estimated that most of this head would be absorbed in winter by the increased river slope due to ice conditions. The structures creating the lower pool were, however, to be so designed that the pool level could be raised to recover a part of the head lost at the Ogden Island dam if desired at a future time.

The Joint Engineering Board concurred in the opinion that the improvement of the international rapids section should include the development of power. Its length is such that a side canal for navigation would be extremely costly and would impose an unnecessary hindrance to shipping.

The board gave extended study to various plans for improving the river for power and for navigation, including those presented by the Hydro-Electric Power Commission of Ontario and the International Joint Commission, as well as to

others submitted by American corporations to the Water Power Commission of the State of New York. The board came to the conclusion that the plan presented by the International Joint Commission, although in a general sense practicable, should be modified to secure more dependable winter operation, and to ensure the greatest practicable utilization of the power resources of the river.

Two plans meeting these requirements were prepared by the Joint Engineering Board, one for a single-stage development, with a dam and power houses in the vicinity of Barnhart Island, at the foot of the reach, but with control gates at Galop Island, at the head of the reach, except across the channel provided for navigation. The second scheme is for a two-stage development with two pools, the upper pool being formed by a dam and power house at Ogden Island, just above Morrisburg, and the lower pool by a dam and power houses at Barnhart Island.

With the single-stage development, navigation enters the pool through a free channel from the upper river and passes from the lower end of the pool through a canal with two locks, on the United States side of the river leading to the south channel at Cornwall Island, thence a free channel leads to Lake St. Francis. With the two-stage development, navigation similarly enters the upper pool through a free channel, passes from the upper to the lower pool through a lock at Ogden Island, and from the lower pool to the south channel at Cornwall Island by a canal with two locks, as in the single-stage scheme. The two-stage scheme requires one more lock than the single-stage.

The levels of the pool of the single-stage development during the ice free months, after the full estimated channel

enlargements have been made, will vary according to the level of Lake Ontario, and the flow of water as determined by the programme of regulation.

Further channel enlargement below the power houses may lower the tail water somewhat and add to the head, but the increased power made available is not considered in the board's report. The normal summer head at the power houses of the single-stage development will, therefore, be about 85 feet. The increased slope of the pool in winter, due to ice retardation, is expected to amount to about six feet, and a rise of about four feet in the tail water levels is anticipated from the increased slopes below the power house, so that the net winter head expected is about 75 feet.

With the two-stage development, the lower pool will be kept closely to the same elevation during summer and winter, giving a summer head of 67 feet and a winter head of 63 feet. The summer levels of the upper pool at the Ogden Island power houses will also vary, but only to a slight extent. On account of the slopes of the lower pool, the summer head at the Ogden Island power houses will be about 17 feet and a winter head of 12 feet is expected. The plans and estimates provide for the utilization of a head of 21 feet temporarily during the period between the completion of the upper and the lower plants.

The maximum flow which the Joint Engineering Board regards as eventually utilizable at the Barnhart Island power houses is 245,000 cubic feet per second at winter head. The equivalent capacity at summer head, in the single-stage development, will be 261,000 cubic feet per second, and in the two-stage development, 252,000 cubic feet per second. The utilization of such large flows will not be economically justified at

the Ogden Island power houses of the two-stage development, and the ultimate installation at these power houses is based on a flow of 212,000 cubic feet per second at winter head equivalent to 240,000 cubic feet per second at summer head. The installed capacity of the power houses of the single-stage development, based on the summer head and flow, is 2,326,000 h.p. The installed capacity of the two-stage development on the same basis is as follows:

	Horse power
Lower power house, Barnhart Island	1,808,600
Upper power house, Ogden Island	406,400
Total	2,215,000

The fact must be appreciated that the additional capacity proposed in the single-stage development is not a measure of power that can be delivered. Except for the slightly less efficiency of the machinery of the Ogden Island power houses, which would not materially affect the total, the power that can be delivered depends on the flow of water available, which will be less than the installed capacity of the plants for a considerable part of the time.

As for winter operation, the pool formed by the single-stage development is so wide and deep as far upstream as Ogden Island, that an ice cover will quickly form over it. The plans and estimates provide for the eventual enlargement of the restricted portions of the river from Ogden Island as far upstream as Lotus Island, at the foot of the Galop Rapids, to the extent necessary to secure current velocities not exceeding 2.25 feet per second, in order to assure satisfactory ice conditions in winter. The contracted section from the foot of Lotus Island to the head of Galop Island, two and a half miles

in length, is to be given the area required for satisfactory navigation only, and is expected to have an open channel in winter, but the extent of this open water would be too limited to be of serious consequence in winter operation.

The amount of channel enlargement required to assure satisfactory winter operation cannot be predicted in advance with certainty. It is proposed to execute initially only such enlargement as is necessary to ensure satisfactory navigation conditions, and to prosecute this enlargement after the pool has been created, when dredging can be done more advantageously, until satisfactory winter operation is secured. The control of the head through the section afforded by the control gates at the Galop will afford a means for ensuring the winter discharge capacity of the river during this period.

In the two-stage development, some enlargement in the channels in the eight mile reach between Ogden Island and Weavers Point is required to secure the desired low current velocities to assure winter operation. Above Ogden Island, the enlargement necessary would be identical with that required in the single-stage development. This enlargement must be completed before the entire scheme is put into operation in order to ensure control of the winter flow and provide uninterrupted power at the Ogden Island plant.

The cost of the single-stage development, including the full channel enlargement to ensure satisfactory winter operation, is estimated at $235,000,000. The cost of the two-stage development is estimated at $264,600,000. The United States section of the Joint Engineering Board recommended the single-stage scheme as affording better navigation by eliminating one lock, and slightly more power, at a cost of $29,600,000 less than the cost of a two-stage development.

The Canadian section of the board recommended the two-stage development on the ground that it can be carried out in two parts, so that the power from the upper development can be generated and marketed before the whole of the improvement is completed. It believed that for this reason its cost, including interest charges, would not be as greatly in excess of the single-stage development as appears from the comparative costs without interest charges. It believed that the control over the flow of the river would be better assured, and the flooding of land would be reduced from approximately 28,000 acres to about 18,000 acres.

Whatever plan be adopted, there is a choice of sites for the dam and power houses in the vicinity of Barnhart Island that create the pool of the single-stage development, or the lower pool of the two-stage plan. A suitable site for the dam exists at the foot of the Long Sault Rapids, on an arc extending from the head of Barnhart Island to the foot of Long Sault Island, and thence to the United States shore. With a dam at this site the channel between Barnhart and Sheek Islands would be utilized as a forebay channel to the power houses which would be erected at the foot of Barnhart Island.

This general arrangement was contemplated in the report of the International Joint Commission. For the two-stage development, the Joint Engineering Board propose to supplement the capacity of this forebay channel by utilizing also the channel known as Bergen Lake, between Sheek Island and the Canadian shore. The low banks prevent the use of this channel for that purpose at the high levels of the single-stage scheme. With the dam built at the foot of Long Sault Island the navigation canal from the pool would leave the river at the

middle of the island, and it would be almost seven miles in length.

The second site for the dam is across the main river at the foot of Barnhart Island, where the foundation rock is deep. With a dam at this site, the navigation canal would leave the river at Robinson Bay, and its length would be reduced to practically three miles, the power houses being adjacent to the dam. Two alignments for the dam and power houses at this point are shown on the board's detailed plans, either of which is regarded as being satisfactory.

The United States section of the board prefers the building of the dam at Barnhart Island because it shortens the length of the navigation canal, reduces the chance of local ice difficulties in winter, since the section of the pool above the power houses is ample to ensure a firm ice cover, and simplifies operation through the juxta-position of the dam and power houses. The Canadian section prefers the location at the foot of Long Sault Island on account of the higher rock foundations to be found there, and these, it believes, will lessen construction difficulties. The choice between the two sites is regarded as a matter of detail to be settled by the constructing agencies after the general type of development has been determined.

An alternative two-stage project is described in Appendix C, paragraphs 121 to 134, of the Report of the Joint Engineering Board. This probably lends itself to a gradual development better than the other projects, and it is expected to give more satisfactory financial returns than the Ogden Island two-stage plan. It is also anticipated that it will afford better control of the flow, and it is put forward as the best form of development from Canada's point of view. The head obtained

in this scheme is 25 feet at Crysler Island and 60 feet at Barnhart Island. New water levels would not be raised above the general level of the country, and a good foundation at moderate depth is available at Crysler Island.

The plans for the single-stage development submitted with the report of the Joint Engineering Board show the dam across the main river channel at the foot of Barnhart Island, and those for the two-stage plan show it at the foot of Long Sault Island. In the opinion of the board, either site can be used with either development, and whether the single or the two-stage scheme is finally selected as best meeting the joint interests of the two countries, the board points out that the use of water at the power houses, and the operation of the sluice gates, which with the wheels control the flow of the river, should be under the control of an international board.

This board, it is suggested, should be possessed of full authority to take such measures as will ensure the regularity of flow that is necessary in the interest of navigation in the lower river, and of the power houses downstream, and to ensure such flows as will maintain the levels of Lake Ontario within proper limits while preserving the volume of flow required to prevent injury to navigation at and below Montreal.

Regarding the improvement of the river for navigation only, the Joint Engineering Board found that the cheapest method is the construction of a side canal on the American shore from the Galop Rapids to Ogden Island. Navigation would enter a pool to be formed by a dam at the head of the Long Sault Rapids, and from this pool pass to the south channel of the river at Cornwall Island through a canal on the same line as that proposed for the two-stage development.

It is pointed out, however, that navigation provided by such a plan would be inferior to that afforded by either the single or the two-stage power developments. The estimated cost is $79,000,000.

The two alternative schemes for the improvement of the International Rapids section in the joint interest of navigation and power, as presented by the Joint Engineering Board as best providing for the development of the capacity and possibilities of this section, are estimated to cost:

(1) Single-stage development:

Works solely for navigation	$ 22,000,000
Works common to navigation and power	106,500,000
Works primarily for power—	
Substructures and head and tail race excavation	42,000,000
Superstructures and machinery	64,500,000
Total cost (2,326,000 installed h.p.)	235,000,000
Initial cost with installation of 1,163,000 h.p. (remaining installation deferred awaiting growth of market)	203,000,000
Estimated initial expenditure to open navigation and provide 1,163,000 installed h.p. before channels are enlarged to ensure winter operation	190,000,000

(2) Two-stage development:

Upper pool—		
Works solely for navigation	$ 8,093,000	
Works common to navigation and power	53,726,000	
Works primarily for power—		
Substructures, head and tail race excavation	23,737,000	
Machinery and superstructure	33,829,000	
		$199,385,000
Lower pool —		
Works solely for navigation	25,388,000	
Works common to navigation and power	37,130,000	

Works primarily for power—		
Substructures, head and tail race excavation	36,866,000	
Machinery and superstructures	45,777,000	
		145,161,000
Total cost (2,215,000 installed h.p.)		$264,546,000
Estimated initial expenditure to open navigation and provide 406,400 h.p. in upper plant and 756,600 h.p. in lower plant (remaining installation in lower plant deferred awaiting growth of market)		238,400,000
Estimated initial expenditure to open navigation and provide 1,163,000 h.p. at lower plant (remaining installation at lower plant and all that of upper plant being deferred)		$214,500,000

The foregoing estimates exceed those given by the International Joint Commission in their report because they provide for a greater power development, and more elaborate measures to ensure satisfactory winter operation, besides which they are based on the higher unit of costs indicated by the more detailed studies made by the Joint Engineering Board.

Lake St. Francis Section.—This section extends from Colquhoun Island, opposite St. Regis, to deep water at the foot of Lake St. Francis, a distance of 26 miles. The currents through the lake are sluggish and the total fall throughout the section is about one foot. The lake contains a number of shoals but deep water channels extend through it. The work proposed is the dredging necessary to secure a suitable channel, and the recommendations of the Joint Engineering Board are substantially the same as those of the International Joint Commission. The estimated cost of a channel 25 feet deep is $980,000.

Soulanges Section.—This section of 18 miles extends from deep water in Lake St. Francis to deep water in Lake St. Louis. The river falls from Lake St. Francis in a succession of rapids, with the Coteau Rapids at the head, the Split Rock and Cascade Rapids at the foot, and the Cedar Rapids about midway. The total fall through the section at present mean stages of the two lakes is 83 feet. The Soulanges Canal runs parallel to the river on the north affording 14 foot navigation throughout.

The Joint Engineering Board found that it is practicable and advantageous to combine the improvement for navigation with the development of power on a progressive programme of construction of power plants, only the first part of the power development being undertaken in conjunction with the works required to carry navigation through the section.

The board's plan provides for a dam at the head of the Cedar Rapids which will create a pool having a level from one and a half to five feet below the level of Lake St. Francis. The shores of this lake are so low that the raising of its high water levels would destroy considerable areas of agricultural land which, apart from the large expense involved, is highly undesirable. The plans, therefore, include an extensive enlargement of the discharge capacity of the Coteau Rapids to ensure that the backwater slope will not raise the high levels of the lake.

Navigation passes from Lake St. Francis to the pool by a canal round the Coteau Rapids, three miles in length, with a low lift lock. Even with the enlargement proposed, the currents in these rapids will be too swift for safe navigation, and especially for safe passage through the draw in the railway bridge which here crosses the river. The canal has, however,

been so planned that it can be converted into an open channel when traffic justifies the large additional cost. A second canal, five miles in length, with two lift locks, carries navigation from the pool to Lake St. Louis. These locks may be either in flight or separated by a short pool as the difference in cost in favor of the separate locks is small.

The first part of the power development is the generation of a total of 382,000 h.p. at a power house with a 22 foot head incorporated in the dam. The present Cedar plant will be continued in operation, water being fed into the headrace through sluice gates. The second part of the progressive development is the installation of 500,000 h.p. at 75 foot head, at a power house on the shore of Lake St. Louis, north of Cascade Point, near the Chamberry Gully. It will be supplied through a headrace canal formed partly by the enlargement of the navigation canal. The third part is the construction of a dam and power house with a 53 foot head at the Cascade Rapids, which will develop a total of 974,000 h.p. The present Cedar plant will then be put out of operation.

The estimated cost of these works is as follows:

First part, including navigation works	$103,945,000
Second part	37,291,000
Third part	63,816,000
Total	$205,052,000

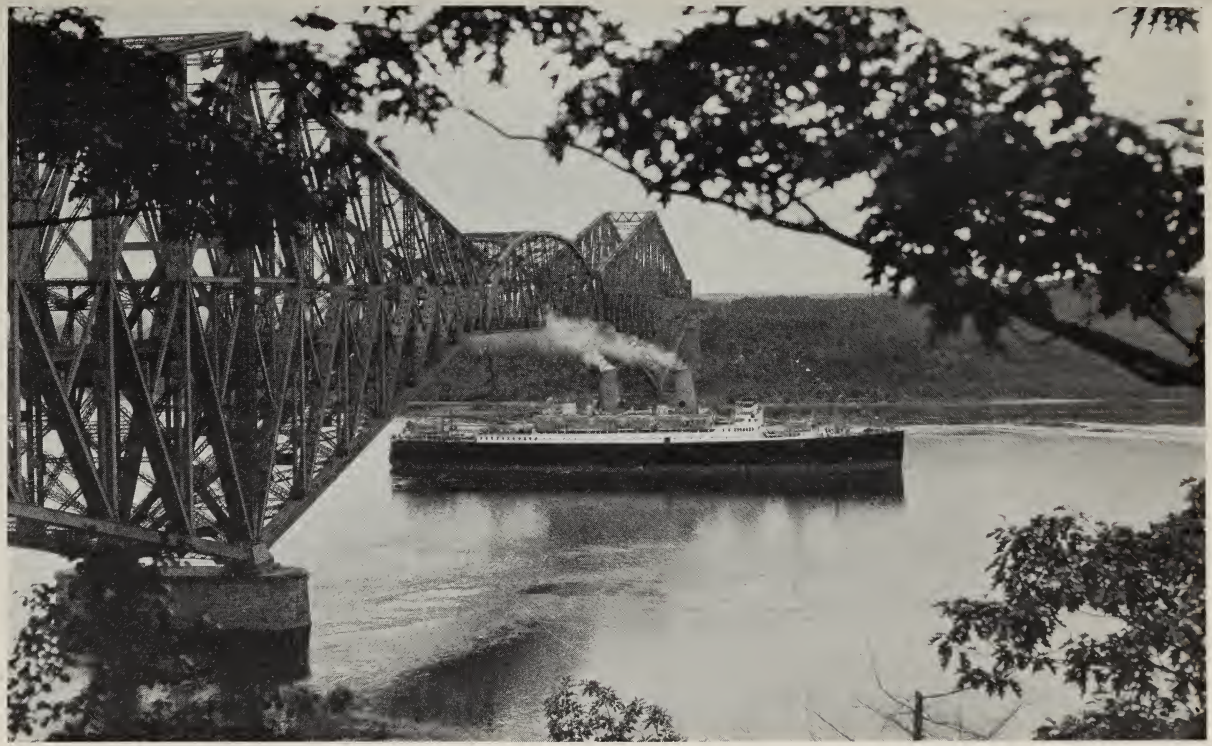
The installed capacities of these plants, including spares, at normal summer heads are:

	H.P.
First part	404,000
Second part	545,000
Third part	1,030,400
Total	1,979,700

If only half the hydro-electric machinery is installed when the first part of the programme is constructed, leaving the other half to be installed as the demand for power develops, the expenditure required to open navigation and provide 202,000 h.p. becomes $92,000,000.

An alternative scheme which affords the maximum open river navigation, involves the initial construction of two dams with power houses, the upstream dam substantially on the line of the one proposed in the first part of the recommended scheme, and the second dam and power houses at the Cascade Rapids, at the site of the structures forming the third part of the progressive power development therein contemplated. Navigation would pass from Lake St. Francis to the pool formed by the upstream dam as in the recommended scheme. From this pool it would pass through a short canal and lock to the pool formed by the Cascade dam and power houses, thence through a lock directly to Lake St. Louis. The five mile canal, provided for in the recommended scheme between the upper pool and Lake St. Louis, would be eliminated.

The pool of the Cascade dam would give a 43 foot head between this pool and Lake St. Louis instead of the 53 foot head contemplated in the third part of the recommended project, and this change would reduce the difference of levels to a conservative lift for a single lock. The power houses at the upstream dam would be so placed as to develop the remaining 30 feet of head available in the section. The scheme would entail the reconstruction of the existing Cedar power plant as part of the initial work instead of permitting a postponement until the last part of the power development programme.



S.S. *Duchess of Atholl* passing under Quebec Bridge

Courtesy Department of Immigration and Colonization, Canadian Pacific Railway

The total cost of this alternative scheme, with a complete eventual installed capacity of 1,948,000 h.p., would be $194,-317,000, or approximately $10,700,000 less than the cost of the plans recommended. On the other hand, the initial expenditure would be greater than in the case of the recommended plan. The initial power installation must include, in addition to such new power as is provided, an installation of 207,000 h.p. to replace power lost at existing plants, this being 197,000 h.p. at the Cedar plant, and 10,000 at the other plants. The initial expenditure required to open navigation, and to provide an installation of 404,300 h.p. of new power, together with this replacement of power at existing installations, would be $123,400,000, against the minimum initial expenditure of $103,945,000 required with the same installation of new power under the recommended plan.

Unless the power can be sold more rapidly than the Joint Engineering Board believed, interest charges of $19,455,000 increased initial cost, would outweigh the $10,700,000 difference between the ultimate costs of the completed projects indicated by the foregoing estimates. The scheme makes a maximum use of the river, and merits serious consideration if a market for the large amount of power can be developed within a reasonable period.

The schemes studied by the Joint Engineering Board for providing navigation alone are:

Firstly, a lateral canal on the south side of the river extending from Hungry Bay to Melocheville, at an estimated cost of $33,640,000;

Secondly, a lateral canal on the north side of the river so designed as to conform to an eventual combined improvement of the river for navigation and power. Essentially,

this scheme embraces the construction of the upper and lower lateral canals proposed in the combined improvement, with a land canal connecting them, the latter to be abandoned when the river is improved for power. The estimated cost of the canal complete is $40,378,000. The part of the land canal that would be abandoned for navigation would be used partly for drainage. Its estimated cost is $6,382,000, and the estimated cost of the river connections is $1,922,000;

Thirdly, a river improvement, as proposed in the recommended scheme, with substructures for power plant, but without power installation, at an estimated cost of $78,515,000.

In its conclusions regarding the possibilities of this section of the river, the Joint Engineering Board is of the opinion that the navigation improvement, combined with the progressive development of power, provides in a more satisfactory manner for the present and future development of the waterway than any scheme for navigation alone, and it is, therefore, the one to be desired if arrangements can be entered into whereby power interests bear a fair proportion of the cost of the initial expenditure required. If it be found impossible to arrange for this co-operation, a majority of the Canadian engineers favors the construction of the lateral canal on the south side of the river—Hungry Bay to Melocheville—which is the least expensive means for providing navigation.

The United States engineers are of the opinion that a route designed to serve so large a territory will demand eventually the freer navigation of an open river. It believes, therefore, that even if arrangements cannot be made for the participation of power development in the initial improvement,

it will be better to adopt the river development—third scheme —or a canal on the north side capable of conversion into a river development—second scheme—rather than the Hungry Bay to Melocheville route, the investment in which would be to a great extent lost when a river development scheme is adopted.

A general analysis of the estimated cost of the initial part of the recommended combined navigation and power project is as follows:

Works solely for navigation	$31,594,000
Works common to navigation and power	34,686,000
Works primarily for power:	
Substructures and head and tail race excavation	13,079,000
Superstructure and machinery	24,586,000
Total	$103,945,000
Cost of initial installation of one-half of power machinery	$92,000,000

Lachine Section.—This section extends from deep water at the head of Lake St. Louis to Montreal, a distance of 26 miles. The first 11 miles are through the deep water in the upper part of the lake, and the next four miles run through the shoal water at its foot. From here the river flows for five miles in swift currents, through a channel badly obstructed with rock reefs, to the Lachine Rapids. It drops through these rapids to La Prairie Basin, a wide expanse of shoal water five miles in length, thence through a mile of swift-running channels to the harbor of Montreal.

The total fall through this section is about 48 feet, of which nine feet are between the upper end of Lake St. Louis and the head of the Lachine Rapids. In the rapids themselves there is a fall of 24 feet; another four feet through La Prairie Basin, and 11 feet between La Prairie Basin and Montreal. The course of the river from Lake St. Louis

to Montreal describes a wide bend to the south, and the present 14 foot navigation passes through the Lachine Canal which cuts through the city across this bend.

In this section the St. Lawrence River begins to receive water from the Ottawa River. This latter river discharges into Lake of Two Mountains, which lies just north of Lake St. Louis, and is at a slightly higher level. Lake of Two Mountains discharges part of its flow through the two outlets into Lake St. Louis, and the remainder into the St. Lawrence below Montreal. On account of the widely varying flow of the Ottawa River, the range in the levels of Lake St. Louis is about eight feet.

The improvement proposed for the Lachine section by the International Joint Commission was a side canal of nine miles, with two lift locks and one guard lock, extending from the upper entrance to the present Lachine Canal, across the bend in the river to a point on the shore three miles above Montreal harbor, and thence along the shore to the harbor itself. The eventual increase in depth from the 25 feet provided for by the International Joint Commission to 30 feet, was to be secured by a dam in the Lachine Rapids which would raise the low water levels of Lake St. Louis and the upper canal level by five feet. The International Joint Commission considered but did not recommend an alternative project for combining navigation and power by constructing a dam and power works in the Lachine Rapids.

The Joint Engineering Board examined with care the feasibility of utilizing the contracted section of the river above the Lachine Rapids for navigation in connection with power development, but found that, without an excessive amount of costly excavation, the currents created by the con-

centration of the flow in the excavated channels would be excessive for navigation, even if the railway bridge, which here crosses the river, were raised in order to provide overhead clearance. In the opinion of the board, therefore, a side canal provides the most suitable route for navigation between Montreal and Lake St. Louis.

The westward growth of the built-up sections of the city of Montreal has already encroached on part of the route selected for the canal by the International Joint Commission. The Joint Engineering Board realize the importance of building the canal on a site that will not interfere with the future growth of the city. This will eliminate the difficult problem of the crossing of land and water traffic, with the consequent inconvenience and delay to both. The route proposed, therefore, follows close to the river bank throughout and, consequently, cuts off no area capable of urban development. Its length and cost are substantially the same as on the route recommended by the International Joint Commission.

The canal has three lift locks and a guard gate, instead of two lift locks and the guard lock proposed by the International Joint Commission. Four miles are in land cut with minimum section, and the remaining six miles, counting the length to the end of the Lachine breakwater, have a minimum width of 300 feet. The additional lock assures the minimum of alterations in sewerage and water supply systems, including the Montreal aqueduct, but if the project is adopted details can be modified to conform to any suggested changes in these public utility undertakings.

The excavation of the upper level of the canal, and through the long shoals at the foot of Lake St. Louis, can be reduced by the construction of a control dam in the river

at the head of the Lachine Rapids, above Heron Island, to raise the low water levels of Lake St. Louis during the navigation season. Since at low stages this would back the water up into Lake of Two Mountains, and slightly raise the low water levels of the latter, it is necessary to construct supplementary control works at the two northern outlets of that lake, Mille Isles and des Prairies Rivers, in order to preserve the present distribution of the flow of the Ottawa River, and to prevent a reduction in the flow in the main channel of the St. Lawrence past Montreal.

The cost of the entire system of control works is about $2,000,000 in excess of the saving in excavation costs, but these works will reduce the cost of a future development of power at the Lachine Rapids, besides being of benefit to local navigation on the two lakes. Their construction is, therefore, desirable, and is included in the plans of the initial improvement for navigation at a complete estimated cost of $53,000,000.

As to power development, the Joint Engineering Board concurs in the views expressed by the International Joint Commission, that the practicable power production in this section of the river is limited to the development of the head of a little more than 30 feet available above the foot of the Lachine Rapids. The winter rises of the river drown the remaining head, and the upper level of a power development cannot be carried below the foot of these rapids without causing widespread flood damage.

To ensure the safe and dependable winter operation of a power development at the Lachine Rapids, the discharge capacity of the contracted reaches above these rapids should be so enlarged that the maximum winter current velocities

would not create ice gorging. The alternative of a development based on maintaining an open channel through the river in winter is rejected as hazardous, for the same reasons that such a proposal was rejected in the case of the International Rapids section.

The most feasible method of enlarging the discharge capacity of the river is found to be the construction of a deep, concrete lined headrace canal, on the south side of the river. The plans for improving the river for power provide, therefore, for a development in two parts. The first part is the construction of such a power canal along the south shore, from the foot of Lake St. Louis to the Lachine Rapids, designed to carry a flow of 120,000 cubic feet per second at so high a velocity that an ice cover cannot catch across to form an ice jam. The water would be delivered to a power house on the south shore at the foot of the rapids, discharging into La Prairie Basin, which would develop 391,000 h.p.

A control dam in the river, with auxiliary structures at the outlets of Lake of Two Mountains, is required with the first part of the development to prevent the lowering of Lake St. Louis by the large diversion of water and to secure the maximum allowable head at the power house. The main control dam in the river would be at the head of the Lachine Rapids, and the normal regulated level of the lake would be the same in both cases. The auxiliary control structures would be identical, but the main control dam would require a different design.

The dam proposed in connection with navigation improvement is designed with wide openings to be left clear in winter in order to prevent the danger of the formation of an ice jam. With the power canal in operation, the currents

in the main river would be so reduced as to eliminate the danger of an ice jam, but the openings must be reduced to such dimensions as will afford safe and convenient winter operation of the gates. A dam constructed initially for navigation purposes would, therefore, require alterations when the first part of the power development is undertaken. The cost of these alterations is estimated at $281,000. The estimated cost of the first part of the development is $88,131,000, if no control dam has been built for navigation purposes, and $81,247,000 if such a dam has been built, the latter figure including the necessary modifications in the dam.

The second part of the improvement for power is the development of 422,000 h.p. from the remaining flow of the river, at a power house to be constructed in the main river at the foot of the Lachine Rapids, adjacent to the power house constructed in the first part of the development. The headrace to this power house would be formed by a wall, extending downstream from the control dam previously constructed to the new power house, and by opening the portion of the control dam between this wall and the south shore. The estimated cost of the second part of the development is $41,966,000.

If the first part of the power development be undertaken simultaneously with the navigation improvement, the estimated combined cost is $133,358,000. On the other hand, if the first part of the power development be undertaken subsequently to the navigation improvement, requiring the alteration of the control dam initially constructed for the latter purpose, the combined cost would be $134,247,000.

The economic saving from combining power development with the improvement of the Lachine section for navigation

is, therefore, only $889,000, and this saving would soon be counterbalanced by the interest charges on the large investment necessary to secure it, unless the power could be marketed promptly at remunerative rates. For this reason, and on account of the high cost of developing power in this section of the river, as compared with its cost in the Soulanges section, the board did not include power development in its plans for the initial improvement of the Lachine section. The generation of power can be undertaken when it is found to be economically justifiable from the standpoint of power production alone.

In summary, the estimates for this section are as follows:

Recommended project for navigation alone	$ 53,000,000
Power alone:	
First part, 435,000 installed h.p.	$88,131,000
Second part, 488,000 installed h.p	41,406,000
Total, 923,000 installed h.p.	$129,537,000
Power subsequent to navigation:	
First part, 435,000 installed h.p.	$81,247,000
Second part, 488,000 installed h.p.	41,966,000
Total 923,000 installed h.p.	$123,213,000

GENERAL SUMMARY LAKE ONTARIO TO MONTREAL

The plans recommended by the Joint Engineering Board for the improvement of the St. Lawrence River provided for a navigation route through the 183 miles of lake and river from Lake Ontario to Montreal, with a total not exceeding 25 miles of restricted canal navigation with not more than nine locks and crossed by eight bridges. The plans include power houses with an ultimate installed capacity of from 2,619,000 to 2,730,000 h.p., and permit of the eventual development with installed capacity of approximately 5,000,000 h.p.,

which is considered to be the full potentiality of the river. The estimated expenditures required to open navigation with channels 25 feet in depth, with an initial power development having one-half the ultimate installed capacity of the power houses first constructed, the installation of the remainder being deferred to await the growth of the market, are as follows:

(1) Total cost of improvement if with a single-stage development in the International Rapids section (1,365,000 h.p. initially installed) $350,100,000

(1a) Above improvement before channels are enlarged to ensure winter operation 337,100,000

(2) Total cost of improvement if with a two-stage development in the International Rapids section (1,365,000 h.p. initially installed) 385,500,000

(2a) Above improvement if the initial power installation in the International Rapids section is all made at the lower (Barnhart Island) plants 361,600,000

After all the machinery in plants recommended by the board has been installed these costs will become:

(1) If with a single-stage development of the International Rapids section (2,730,000 installed h.p.) $394,000,000

(2) If with a two-stage development of the International Rapids section (2,619,000 installed h.p.) 423,600,000

The board considered it advisable to present alternative plans and estimates in several instances, for the reason that a choice between them rests on broad questions of policy rather than upon strictly engineering considerations. Thus, the estimated cost of additional channel excavation required to provide channels initially 27 feet deep, from Lake Ontario to Montreal, instead of 25 feet deep is $5,800,000. Alternatively, the estimated saving in the cost of channel excavation, through providing channels initially 23 feet deep instead of 25 feet deep, is $5,350,000. The estimated cost of subsequently

enlarging to 30 feet in depth, channels initially excavated 25 feet in depth, is $24,400,000.

The estimated cost of additional works required to complete the full practicable development of power in the river, with works having an installed capacity of 2,500,000 h.p., is approximately $225,000,000. The total eventual power installation is approximately 5,000,000 h.p., and the total eventual cost of developing this power, and of providing navigation with channels 25 feet in depth, is in round figures from $620,000,000 to $650,000,000, according to the form of improvement adopted in the International Rapids section.

A general analysis of these costs is set out in detail in Appendix II.

THE ST. LAWRENCE SHIP CHANNEL

The St. Lawrence from Montreal to the Atlantic Ocean is the developed portion of the river flowing exclusively through Canadian territory in which the United States enjoys by treaty right equal privileges of navigation with Great Britain. Through participation of all Canadians in its development ocean ships of any size may come to Quebec, and ships of 20,000 tons are in regular service to Montreal.

From the Atlantic Ocean to Father Point, 663 miles, the natural open channels of the River St. Lawrence are five to 20 miles wide, and deep enough for ships of any draft to navigate. From Father Point to Quebec, 189 miles, the minimum width of the channel is 1,000 feet, and the minimum depth 35 feet.

From Quebec to Montreal the ship channel varies in width from a minimum of 450 to 750 feet in the straight, and 1,000 feet at the bends, having a present depth of 30 feet, now being increased to 35 feet. Natural widths and depths in

excess are available for a large portion of the distance. Among those unacquainted with these facts, the impression sometimes prevails that the St. Lawrence is a long stretch of restricted navigation. The best evidence against this is that 20,000 ton ships, with a speed of 18 knots, now use it to Montreal, and that 40,000 ton ships, with a speed of 24 knots, will come to Quebec by 1930. This wonderful development has been achieved by the vision, courage and enterprise of the Canadian people.

The way to Europe via the St. Lawrence is over 200 miles shorter than by New York, and gives two days' steaming in sheltered waters, through the best lighted and marked inland waterway in the world.

Not only is this channel used by ocean freight vessels, but it is also used regularly by large combination passenger and freight liners. The St. Lawrence route is becoming increasingly popular for passenger traffic with the United Kingdom and Europe. There are more of these fast, modern combination liners to be seen at Montreal up to 20,000 tons than at any other port on the continent, except New York. Any traveller who has visited the various ports of the Atlantic, Gulf and Pacific coasts, and observed the types and sizes of vessels regularly entering and departing, cannot fail to have been impressed by the superior vessel service afforded by the port of Montreal. The fact that the Canadian Pacific, Cunard and White Star, and other companies, operate these modern liners in regular service to and from Montreal, is in itself evidence that the channel is not restricted to an extent necessitating slow speed, because speed is one of the essentials of this kind of service.

How do the dimensions of the ship channel up to Montreal compare with other river channels regularly used by ocean vessels? A few examples will suffice to answer this question:

	Length miles	Depth feet	Width feet
St. Lawrence River from Father Point to Montreal	340	30	450-1,000
Delaware River up to Philadelphia	101	30	800-1,000
Mobile Bay to Mobile	40	27	300
Columbia and Willamette Rivers up to Portland	113	30	300
Houston Ship Channel	50	25	100-150
Amazon River up to Manaos	925	24	114
Yangtse River up to Nanking	235	27	...
Hankow	615	20-24	...
Mississippi River up to New Orleans: South Pass	110	30-33	330-700(1)

Historically, the story of the St. Lawrence ship channel is of more than passing interest. In origin it dates back to 1855, when the Hon. John Young of Montreal, and other public-spirited citizens, began an agitation for the improvement of this great natural waterway. As an engineering work the channel is of special interest. When first undertaken it was considered of its kind to be a work of unusual magnitude, and it is still spoken of as being one of the great dredging projects of the world.

Though not the birth place of dredges, the ship channel takes a first place among the works where noteworthy improvements have been applied to dredges and methods of dredging, which have resulted in their present efficiency and development. It is also of special interest to note that, unlike

(1) *Transportation Economics of the Great Lakes-St. Lawrence Ship Channel*, by Alfred H. Ritter, p. 15-18.

most river works, the St. Lawrence ship channel costs nothing for maintenance. From the Great Lakes the pure water passes through the rocky channels of the Thousand Islands and the various rapids that lead to Montreal. Thence the river flows with a gentle current, bearing no detritus, and the artificial deepening, when once made, remains permanent, without either silting up or scouring out of shape.

The St. Lawrence ship channel has become a vital link in the chain of water communication between the Great Lakes and the Atlantic Ocean. In the year 1826, the improvement of the channel between Montreal and Quebec was taken up as a matter of public importance by the Legislative Assembly of Lower Canada. The committee appointed to investigate the matter, having procured plans of Lake St. Peter, and examined a number of witnesses, reported that the importance of the subject required that further information should be obtained.

In the following year the subject was again discussed and a committee was appointed to make further investigations. The need of a thorough survey was felt but, in view of the fact that an Admiralty survey of the St. Lawrence was then in progress, and would soon reach Lake St. Peter, further enquiry was deferred until a report of this survey could be obtained. In compliance with the request which had been made by Sir James Kempt, Captain Bayfield, who made the survey, submitted his observations on the nature of the lake and its channels in May, 1831.

This report, accompanied by a message from Lord Aylmer, the Governor-in-Chief, was transmitted to the House in December, 1831, and referred to a committee of five members. No action followed, however, but again in 1836 the

matter was discussed and evidence taken. The Admiralty chart of the lake had not yet been received, and this seems to have delayed further action. On May 5, 1838, therefore, an ordinance was passed granting £500 for the purpose of making a survey of Lake St. Peter.

Nothing official is recorded of what followed this grant until 1841, when Secretary Daly, referring to a petition by the Board of Trade, wrote to the chairman of the committee that "His Excellency has commanded me to inform you that the improvement of the navigation of Lake St. Peter will be considered with other public works."

An extensive investigation was made by a special committee of the House in August, 1841, as to the "extent of the burden imposed on the trade by the obstructions to the navigation which it is sought to remove," and an estimate of the cost of deepening the channel in the lake to a depth of 16 feet at low water was made by David Thompson. The result of the investigation was the recommendation by the special committee of the House that "measures may be taken to deepen the ship channel in Lake St. Peter."

During this investigation the committee discussed the proposal of a tonnage duty on the shipping coming up to Montreal, but while they believed that a tonnage duty sufficient to provide for the cost of deepening the channel would be less burdensome than the cost of lighterage, they decided that "in order to draw the produce of the west down the St. Lawrence, it is expedient to make the transit charges as light as possible." Action was taken on the recommendation of the report and an appropriation was inserted in the estimates for the commencement of the work, which was described in the

report of the Board of Works for 1841, as a subject of very great importance.

The expediency of the undertaking being now admitted, a question arose as to the best position for the channel in Lake St. Peter. Charles Atherton reported in favor of deepening the natural channel then used in the lake, but his advice was not followed, and work was begun in the "straight" or "Board of Works" channel, in the spring of 1844. However, many of those who were the strongest advocates of the proposed improvements objected to this channel, maintaining that the desired object could be attained sooner, more effectually and at a less cost, by deepening the natural channel. The opposition to the straight channel increased during the progress of the work, causing its temporary suspension in the summer of 1846, and its final suspension in the autumn of 1847.

Discussions and investigations continued until 1850, when the Harbor Commissioners of Montreal proposed a plan for the construction of the work, believing that they could execute it successfully by methods more economical and expeditious than those of the Board of Works. They proposed "that the Harbor Commissioners of Montreal should be authorized to undertake the work and to borrow money, the interest on which should not exceed 8 per cent., and this interest, as well as a sinking fund of 2 per cent., was to be provided for by a tonnage duty not exceeding one shilling per ton register on all vessels drawing 10 feet and upwards for each time they passed through the lake, and should the revenue so collected prove insufficient to pay the interest on moneys borrowed, the surplus revenues of the harbor of Montreal were to be applied to make up any deficiency."

This plan was adopted by the Government, and an Act of Parliament procured in accordance with it (Acts 13 and 14 Vic., Cap. 97, passed August, 1850), authorizing the borrowing of £30,000 for the purpose of proceeding with the work "in such a manner, direction, and place as the commissioners should deem best." Thus far the work had been carried on with dredging plant belonging to the Government under the direct supervision of Government officers, and the plant was now transferred to the harbor authorities for the continuance of the work.

The commissioners appointed a board of engineers to enquire into and report on the best means of obtaining a channel of a depth of 16 feet through Lake St. Peter. After investigating the state and nature of the two channels, these engineers reported in favor of abandoning the straight channel, and of applying the work of improvement to the old or natural channel. The Harbor Commissioners adopted this recommendation and began operations in June, 1851.

Early and continued success accompanied the efforts of the Harbor Commissioners, and a rapid increase of shipping resulted from the available improvements of the channel. By November, 1851, the natural channel of about 10½ feet at low water had been deepened by two feet. In August, 1853, a vessel passed through the dredged channel from Montreal to the foot of Lake St. Peter, drawing four feet more than the original depth of water. In 1855, 16½ feet at low water was attained, and 18 feet depth was available in 1857.

Such results were reassuring, and demonstrated the feasibility of obtaining a channel of the required depth up to the entrance to the Lachine Canal, the natural junction of the ocean and inland shipping of the country. The Harbor Com-

missioners now represented to the Government the national character of the work, urging that the benefits to be derived from the improvements in the channel were not confined to Montreal, but that they extended to the whole of the country lying to the west, and prayed that the revenue of the harbor of Montreal might be relieved of the burden unjustly laid upon it.

John Page, then Chief Engineer of Public Works, in his report on the ship channel, dated January 25, 1869, referring to this matter says: "These views having been repeatedly brought before the Government, after a full discussion of the question, it was decided in 1860 that the river improvements should henceforth be considered as public works."

Thus it is clear that in 1860 the deepening of the ship channel between Montreal and Quebec was recognized and acknowledged to be a public work, and so continued to be considered, inasmuch as in 1866, almost the entire debt of the 20 foot channel was assumed and paid by the Government. Further deepening has been carried on by the Harbor Commissioners, under the authority of the Dominion Government, with funds provided by the sale of Government debentures, the interest on which is paid out of harbor dues.

The decided success which attended the earlier operations of the Harbor Commissioners in the ship channel was surpassed by their subsequent achievements. Through improvements applied to the dredges, their efficiency was greatly increased, both in expediting the work and in lessening its cost. In 1878 a depth of 22 feet in the channel was attained. The work of obtaining a channel of 25 feet was accomplished in 1882, and the further deepening to 27½ feet at low water was then undertaken.

The ship channel was under the jurisdiction of the Montreal Harbor Commissioners from 1851 until 1888, when it was transferred to the Department of Public Works. There it remained until 1904, when the work was turned over to the Department of Marine and Fisheries, who still carry on the work. Under the Harbor Commissioners, the channel was gradually deepened, and when they turned it over to the Department of Public Works in 1888, the section from Montreal to Cap à la Roche had been dredged to 27½ feet at ordinary low water, and from here to Quebec to 27½ feet at half tide. Between 1889 and 1899, the Department of Public Works widened and cleaned up the channel, and deepened the section between Cap à la Roche and Cap Charles to 27½ feet at ordinary low water.

In 1899 work was begun on the 30 foot channel, which was also to be widened to a minimum width of 450 feet and straightened. This important project was carried on throughout the period the ship channel remained under the control of the Department of Public Works, and it was continued by the Department of Marine and Fisheries. In 1910 this latter Department began work in the upper divisions of the river to increase the depth of the channel to 35 feet. ([1])

(1) *Report of the International Joint Commission*, p. 17-20.

Chapter V

HISTORY OF THE NEGOTIATIONS OF THE ST. LAWRENCE WATERWAY PROJECT, 1832-1929

FIRST PERIOD, 1832-1920

"In a word, we may gather out of history a policy no less wise than eternal;" . . . Sir Walter Raleigh, *History of the World.*

Chapter V [1]

JUST how long ago it is since the project for deepening the channels of the St. Lawrence River, in order that ocean-going vessels might journey from the open sea up into the inland harbors of the Great Lakes, first presented itself to the minds of the dwellers on the North American continent, is a question that will probably never be definitely settled. Interesting as it would be to the student of history to know when the idea originally arose there is, unfortunately, little in the way of recorded fact to point to an actual date.

It can be said, however, with all truth, that so long ago as 1832 the question of deepening the St. Lawrence River was receiving some measure of public attention, for in that year a complete and definite scheme or project made its appearance in the form of a pamphlet written by a Canadian citizen under the nom-de-plume of "A Projector."

This is probably the first serious publication to deal with the subject in a comprehensive manner. The pamphlet is entitled, *A Concise View of the Inland Navigation of the Canadian Provinces; The Improvements Already Effected and the Inferences to be drawn from these, towards their Full Practicable Accomplishment, and Practical Value,* By A Projector. St. Catharines, U.C., Printed at the Welland Canal Intelligence Office, 1832.

This pamphlet consists of twenty pages of closely printed matter, and it must surely be the earliest publication in existence to be written expressly with the object of advocating the

(1) *The Canadian Annual Review of Public Affairs,* 1919, and subsequent volumes.

desirability, if not the necessity, of a deepened waterway. In his opening sentences the writer conveys the impression that he was, even in those early days of scientific knowledge and engineering skill, prepared to go a good deal further than the words of his pamphlet implied; it might be assumed that his recommendations and suggestions were to be considered as being in the nature of the "thin end of the wedge." Somewhat modestly, he says:

> . . . the first proposers and promoters of great and beneficial undertakings are almost universally compelled, by prudence, from offering to the world their original and conclusive persuasions. These they are obliged to relinquish partially, lest proposing and promising too much, their projects might be rejected as chimerical and wild. They are thus led to compromise their own decisions and judgment, to promulgate what they believe will be accredited, and to ask what they trust will not be refused. They bring their speculations to the level of the existing ideas, and the probable enterprise of the country.

That the question of ocean-going vessels on the interior waterways and lakes of North America was occupying a considerable amount of public attention almost a century ago is further made clear by the following paragraphs:

> From the imperfect and irregular information which has been, from time to time, communicated to the publick of Upper Canada, a very incorrect and insufficient estimate is generally entertained, on the extent of those indirect burthens which we sustain, from not possessing an uniform, adequate, speedy, and consequently cheap internal communication with the sea-board; by which the rate of transport would be diminished on our exported produce and imported wants. . . .
>
> Every man who knows the loss of time, the injury, accidents and expense he suffers by the length and badness of his market-town road, may by comparison infer the accumulated increase of expense which now oppress our commerce and produce. The enlargement and completion of the line of communication, in progress or projected, on a scale suitable to the wants, prospects and resources of the provinces, and placed under an uniform system of well calculated regulations, becomes the universal and paramount interest of every settler in the province.

The wonderful opportunities for the expansion of trade and commerce that existed in Canada a hundred years ago were fully realized by the writer of the pamphlet. He realized, too, the importance of inland navigation by ocean-going ships in its bearing on the future development of America, as well as the attitude of that country to the opportunities presented by a deepened waterway. He says:

> Every one knows the immense, and, in common parlance, unlimited regions, of which our lakes are the centre and market way. The scale of every thing here is indeed great—great in extent, and magnificent in its proportions. The progress of these territories has been no less remarkable, and the prospective rate of their advance, is in accordance with the grandeur of their lineaments.
>
> We possess in Canada, an undoubted and pre-eminent superiority in controlling and directing the productive industry and growing wealth of the western territories. This we may claim, without any invidious encroachment on the joint pretensions of our neighbours. The variety of the projects, and the combination of efforts, which they are now making, while it does infinite credit to their untiring enterprise, plainly proves that the *master key* of the lake regions is not theirs; that while they are seeking, by schemes, at an exorbitant expense, to untie the Gordian knot, the triumph is reserved for us; and that we have only to fulfil the conditions of the prediction, by one decisive and *shear cut.* So long ago as the time of Washington, our superiour natural claims had been scrutinized; and in one of the letters of that distinguished individual, (written in 1788,) I remark, that in speaking of the project which even then began to engage speculative men on internal navigation, he uses the expression, *"if we mean to aim at the trade of the lakes;"* and adds, *"I think we should open all the rivers, and lay them open and free to all."*
>
> Such indeed are the extraordinary prospects of the country in question, in extent and value, that the Americans, with the knowledge of the odds against them, have been, and now are, vigourously acting and calculating on the share they can carry off in the partition of these advantages. Perhaps, too, they reckon something on our comparative supineness. In the first we wish them good luck; but in the last we most assuredly will only look the more vigilantly to our baskets and our own stores, to our obligations, to our posterity and to our country.

To this we are led with increased confidence and alacrity, by the assurance that we hold the vantage ground; that in opposition to their desultory and difficult projects, we have to oppose the unalterable superiority inherently belonging to the provinces, by the possession of the St. Lawrence.

The importance of a deepened St. Lawrence River is emphasized in the following forceful words which the writer further accentuates by printing in italics:

The accomplishment of what remains to be done, must appear to every candid and intelligent mind *the true and all-engrossing interest of U. Canada.* . . . It concerns one great, obvious and practicable common interest—*a system of Inland Communication affecting the whole provinces, on which all future combined or individual enterprises must depend, and without which all other exertions, works or speculations, are but the scattered and lifeless members of a great system, deprived of their vital principle—without power and without use.*

(Although no claim is made to originality in the leading principle on which these views are based, viz. *a ship navigation from the Ocean to the Lakes,* it may be proper to recall, that some systematic regard towards this object was suggested by R. Nicholl, Esq., some years ago, to the Legislature; and it was on this suggestion that the dimensions of the Welland canal were determined on, by reference to the usual depth of the harbours and rivers on and above lake Erie.)

After describing the then existing state of "Inland Improved Navigation," the writer proceeds:

A glance at the map of North America, will show that the St. Lawrence and the Mississippi are the two grand natural outlets for the products and commerce of the immense territories surrounding the lakes; both possess relative advantages, which it is unnecessary, at present, fully to discuss. . . .

The Mississippi, however, has undoubtedly some great natural advantages, particularly in the winter season. It has also unfavourable circumstances in the rapidity of its current, the dangers of its obstructions, and the annual overflowing of its banks, rendering the immediate adjacent country of little avail in facilitating and contributing to the benefits of navigation. . . .

The St. Lawrence is no less distinguished by its magnitude, than the natural advantages which peculiarly adapt it for a safe and permanent navigation. While it presents us a port in the summer season,

in direct line with European commerce, our immense lakes acting as so many reservoirs, prevent those sudden risings of water to which most great rivers are liable.

That surveys had been made and plans for a deepened waterway were in existence at least a century ago, and that the financial aspects of the project had been carefully studied, is conclusively shown in the following paragraphs:

It will be observed that the only obstructions of moment from Montreal to lake Erie, in a distance of 418 miles, is in the St. Lawrence; and from the best information to be obtained, it is found that the distance necessary to construct a canal, does not exceed 37½ miles.

With these facts before us, principally drawn from the surveys of Messrs. Clows & Rykert, and of Mr. Alfred Barrett, can we, without extreme surprise, reflect that such extraordinary and obvious advantages should have been allowed to remain dormant; or can we be astonished that other countries should look on our supineness with still less commendatory feeling? It is true, attempts have been made during the last two years, to obtain Legislative aid for improving the river for the passage of boats, and no doubt a very great reduction in the expense of transit, would be effected; but as this plan subjects property to trans-shipment, it is liable to very serious objections.

On the completion of the Rideau Canal, it is probable, likewise, that barges will be constructed with sails, drawing 4 feet water, 90 feet in length, and 19 feet 6 inches beam. These may leave Quebec by steam for Montreal; thence through the Lachine canal, towed by horses or by animal power; from its termination to Kingston, by steam; proceed by steam or sails to Welland canal; passing which, by horses, to lake Erie, they will thence reach Cleveland, by sails or steam; making the entire transit without trans-shipment.

The chief objections to this mode which have been urged, are, the increase of distance—the late opening in the spring—the small size of the craft to be employed, not being adapted for lake navigation, and the great amount of capital required to form and keep up such an extensive and numerous line of steam tow-boat establishments.

. . . Our burthens can be removed, and our prosperity insured, *only by constructing a ship canal of not less than eight to ten feet depth of water; and thus rendering lake Erie's territories, and the shores of the upper lakes on the same level, a SEA COAST.*

The different tributary streams which disembogue themselves into this immense line of communication, may be then brought into navigable purposes, by private companies or individuals, on the plan now in progress on the Grand river; or, as in other sections of the province, by rail roads, where similar advantages from natural water courses do not present themselves. And thus, in a very short period, if proper spirit prevails, every part of the province will largely participate in secondary benefits, while they are sharing the general relief and prosperity.

It cannot be denied there are seeming difficulties in the way—local prejudices to be removed, and unanimity required throughout the province, to effect this grand design.

This pamphlet by "A Projector," written as it was practically a century ago, is of great value from an historical point of view, and the only copy in existence known to the author of this volume is contained in the Public Archives Library at Ottawa. In view of the rareness of the pamphlet, and of its interest to the student of history, it has been considered advisable to reproduce the few concluding paragraphs so that the substance of the whole publication may be made available as a contribution to the history of the St. Lawrence Waterway project:

It may now be asked, *"does Upper Canada possess the means to effect so gigantic an undertaking?* This is the only serious question for consideration, and shall be now pretty fully met.

We have the authority of Messrs. Clows, Rykert, & Barrett, who have estimated the cost of a steam-boat canal from Prescott to Cornwall, to state the expense of that portion of the line at £200,000. This forms more than one-half of the entire distance, and the sum given is considerably over the strict estimate.

The Welland canal embraces a length of nearly 50 miles, with three harbours, and almost two miles of the deepest cutting in America, (with one exception), and with 340 feet lockage. The entire cost, when finished, will not equal £400,000.

There is no deep cutting on the whole line of the St. Lawrence. You can gain a summit at pleasure, and choose your depth of cutting; or by continuing in the river, reduce the length of cutting within *forty miles,* with 200 feet lockage. There is, therefore, no reason to suppose, comparing it with similar works, it will cost over £500,000.

But let us grant that it may cost £1,000,000; this province is as well able to construct it as the British empire; and so far from creating a tax on the people, it would be relieving them from a most oppressive one on the produce and imports of the province, which they are now paying. . . .

The primary object of the canal, undoubtedly, is to benefit the inhabitants of this province. Lower Canada and the mother country will participate. But we should be actuated by far more noble and philanthropick views of its consequences. At least 2,000,000 of people will partake of the benefits flowing from this great work; great, when brought into comparison with our youthful country, but almost insignificant when we look at its far spreading blessings—its progressive and incalculable effects, and its duration!

. . . The above views, founded on facts and necessary deduction, I submit to my fellow-countrymen—the people of Upper Canada; confident that it only requires their attention and consideration to awaken one and all to a full sense of the leading and all-embracing object to which they tend. That being obtained, we have only to adopt means of concentrating the wishes of the province, and to hasten, as far as possible; the period of their fulfilment.

For this purpose there is but one way: let our Representatives pass an act in the approaching session, "TO RENDER OUR INLAND COMMUNICATIONS A THOROUGH AND EFFICIENT SHIP NAVIGATION FROM THE OCEAN TO THE LAKES, BY THE COMPLETION AND CONSTRUCTION OF THE WORKS REQUIRED."

The time is short, but it is sufficient. All that is required is zeal and unanimity, to ensure success; and by rendering *the frontier of Upper Canada a* SEA-BOARD, we will reap, within a very limited period, all the advantages and prosperity which it must command.

Quaint language and quaint terms of expressing his views; quaint punctuation and the quaint use of italics and large type for the purpose of emphasis! What would be the thoughts of "A Projector" if he could return to the world and read the report of the Joint Engineering Board? A canal from Prescott to Cornwall for £200,000! A Welland Canal for £400,000! A population of two million people in the

tributary area increased to forty million! Truly, Jack's beans have grown into a beanstalk!

THE NEGOTIATIONS IN MODERN TIMES

The St. Lawrence Waterway project as it presents itself to the people of the North American continent to-day is more modern than the one so ably described and advocated by "A Projector." It may be said to have first seen the light in 1902. Even then, however, the public had not come into the discussion; it was almost twenty years later that the project began to take its place in the general discussion on topics of the day.

The year 1902 is a convenient one for the commencement of a study of the negotiations for it was in that year that the question first assumed international importance. On June 13 the River and Harbor Act, passed by the United States Congress, requested the President to invite the Government of Great Britain to join in the formation of an international commission to be composed of three members from Canada and three to represent the interests of the United States:

> Whose duty it shall be to investigate and report upon the conditions and uses of the waters adjacent to the boundary lines between the United States and Canada, including all of the waters of the lakes and rivers whose natural outlet is by the river St. Lawrence to the Atlantic ocean, also upon the maintenance and regulation of suitable levels, and also upon the effect upon the shores of these waters and the structures thereon, and upon the interests of navigation by reason of the diversion of these waters from or change in their natural flow; and, further, to report upon the necessary measures to regulate such diversion, and to make such recommendations for improvements and regulations as shall best subserve the interests of navigation in said waters.

On April 27, 1903, the Canadian Government by Order in Council recommended the British Government to accept the above invitation, and on October 16 of the same year the appointment of the representatives of the United States was

announced as follows: Colonel O. H. Ernst, Washington, Chairman; George Clinton, Buffalo, and Professor George W. Wisner, Detroit, Mich. Some sixteen months later, on January 7, 1905, the following Canadian members of the commission were appointed by Order in Council: James P. Maybee, Toronto, Chairman; W. F. King and Louis Coste, both of Ottawa. On Mr. Maybee's subsequent appointment to the Board of Railway Commissioners, George C. Gibbons —afterwards Sir George Gibbons—of London, Ont., became chairman of the Canadian section. The headquarters were in Toronto and Buffalo respectively. The International Waterways Commission, as the new body was called, transacted no business bearing directly on the question of the St. Lawrence Waterway project, although some of the matters that came before it were closely identified with the subject.

On January 11, 1909, a treaty was signed between Great Britain and the United States regarding the boundary waters and questions arising along the boundary waters between Canada and the United States, and setting up the International Joint Commission to succeed the International Waterways Commission. The new body was vested with considerably greater powers than the old.

Nothing of importance in the way of negotiations transpired for four years, when the first real move came from the United States. On July 10, 1913, the Senate unanimously adopted a resolution proposed by Senator Townsend of Michigan:

> Requesting the President to enter into negotiations with Great Britain with the view to securing an international agreement for the concurrent or co-operative improvement of navigation in the boundary waters of the United States and Canada, for the advancement of the commerce of the two countries.

On February 24, 1914, this was followed by a United States note suggesting that a new international agreement would not be necessary for the reason that the Boundary Waters Treaty of January 11, 1909, enabled the two Governments to make the necessary investigation of the subject by means of the International Joint Commission, upon which body Article VIII conferred definite jurisdiction in relation to such enquiries. The United States, therefore, formally requested that there be referred to the International Joint Commission for examination and report the following question:

> In order to secure the most advantageous use of the waters of the Great Lakes, connecting waterways and rivers forming the boundary between the United States and Canada from the tide-water on the Atlantic coast to the head of the Great Lakes for deep-water navigation and transportation purposes, for fishing purposes and for power purposes, and also to secure the most advantageous use of the shores and harbours on said lakes, connecting waterways and rivers, in connection with such deep waterway navigation and transportation purposes, is it practicable, feasible and desirable for the Government of the United States and the Government of the Dominion of Canada to adopt any plan for the co-operative and concurrent improvement of these navigable and boundary waters, either by concurrent or reciprocal legislation or by special agreement between them to the extent of constructing and developing a deep waterway for ocean-going vessels of ordinary draft throughout said lakes, connecting waters, and rivers?

No answer to this despatch is on record, further discussion of the question evidently being postponed until after the war. (1)

In 1918 the long drawn out struggle had come to an end, and the people of Canada were just beginning to take an interest in the domestic affairs of the Dominion, apart from the Imperial questions that were being settled at Ver-

(1) *Proceedings of the Special Committee Appointed to Inquire into the Development and Improvement of the St. Lawrence River*, p. 7-9.

sailles. The St. Lawrence Waterway project, together with the questions of the uses, diversions and allotment, of water power then being generated on the river, and the applications to and the decisions of the International Joint Commission, were then coming prominently before the public eye.

It was estimated that the 24-hour low water power of the St. Lawrence was 2,395,000 h.p., that of the international part of the waterway being about 800,000 h.p., and Canada's share was about 400,000 h.p. The use of these powers was a matter of controversy as to (1) corporate or Government control; (2) the grant of rights on the Canadian side and in Canadian power facilities to United States corporations; (3) the development of unpleasant relations and international friction arising from the application of too hard and fast rules in this connection; with a fear expressed in some quarters of United States retaliation in Canadian coal supplies; (4) the ambition of the Ontario Hydro-Electric Power Commission to see the water powers of Canada conserved for Canadian use alone.

A question of much discussion in 1919, and for more than two years before that, was the application of the St. Lawrence River Power Company—a subsidiary corporation, together with the Long Sault Development Company of the Aluminum Company of America, which was already developing power from the St. Lawrence at Massena Springs, N.Y.—for the right to construct a dam or weir between the lower or eastern end of Long Sault Island in the St. Lawrence and the United States shore, connecting with its canal, and for the purpose of increasing the flow of water to its power plant at Massena which, latterly, was assisting in aluminum production.

In this general connection, and in a diplomatic note to the United States Government so long before as February, 1906, Sir Mortimer Durand, then British Ambassador, stated that it had been represented to the Canadian Government that the Massena Water Power Company had made application to the Government of the United States for permission to dam the south channel of the St. Lawrence River at Long Sault Island. The Ambassador pointed out that the favorable consideration of this application would appear to involve a contravention of the Ashburton Treaty of 1842 between Great Britain and the United States which stipulated that, "the channels in the River St. Lawrence on both sides of the Long Sault Islands and of Barnhart Island, . . . shall be equally free and open to the ships, vessels, and boats of both parties."

When the matter came before the International Joint Commission in 1918 as a war measure associated with the supply of aluminum for British requirements, that body, in response to an urgent communication from the United States Secretary of War—August 23, 1918—granted an order stating that, "as an interim measure the construction of the said weir and its maintenance until the expiration of the term of five years from the date hereof, or until the termination of the present war, is hereby approved." Certain conditions were attached and it was stated that, "in the foregoing order the commission shall not be deemed to have considered nor passed upon any question pertaining to the rights of the applicant to divert water from the St. Lawrence River." The Dominion Government, through the Hon. Hugh Guthrie, Attorney General, had opposed this decision and had sent representatives to Washington to effect some arrangement

which would avoid any grant of rights to a private corporation.

A good deal of criticism followed in the Canadian press, which apparently feared the influence of a large United States corporation upon an international highway. The International Joint Commission, which included C. A. Magrath (Chairman for Canada), with P. B. Mignault, K.C., and H. A. Powell, K.C., as the Canadian members, and Obadiah Gardner (Chairman for the United States), with R. B. Glen and Clarence D. Clark, as the American members, issued in November a statement by Mr. Mignault explaining and defending the judgment. The commission was described as a court with final powers in these matters and, it was explained, its decisions were as carefully given as those of any Canadian court, with the added importance of being international in effect.

Other efforts were made to obtain power rights on the St. Lawrence, notably that of the New York and Ontario Power Company, in which capital from both countries was interested, for additional privileges at the Long Sault Rapids in connection with its plant at Waddington, N.Y. The Dominion Government opposed the application on the grounds that:

(1) It will interfere with the full and economic development of the St. Lawrence system as regards the navigation thereof and the power potentialities therein, which are common to both bordering countries and of equal advantage to each country;

(2) It will interfere with the complete regulation, by a dam at Canada Island, of the level and outflow of Lake Ontario; the future development of the river will necessitate the acquisition of any rights the applicant may have in the river and the Government of Canada considers it inadvisable to create more;

(3) The St. Lawrence River has enormous potentialities that should be developed in the most efficient and economical manner for

future generations. Such a piecemeal policy as proposed is not in conformity with this doctrine.

The Government took up the question with the United States in a broad spirit, looking to a large development of the waterways and their power; at the same time, the commission was studying various projects with a view to special development in the 118 miles of river between Canada and the United States, running from Lake Ontario to Cornwall, and in which it was estimated there was 1,000,000 h.p. capable of use; in this part of the project Sir Adam Beck and the Ontario Hydro-Electric Power Commission were vitally interested. It was understood in September, 1919, that the Governments concerned were discussing a scheme of waterway development so that the St. Lawrence should be made navigable for ocean vessels from the sea up into Lake Ontario at the same time that its power potentialities were being developed. With the completion of the Welland Canal it would thus become possible for ocean vessels to proceed 2,200 miles inland.

To discuss this project a Great Waterways Conference was held at Windsor, Ont., on November 18-19, 1919, with twenty-three cities and towns represented—including Ottawa, Toronto, London, St. Thomas, Washington, New Orleans, Duluth, Detroit and New York. A number of prominent delegates were present of whom F. H. Keefer, K.C., M.P., Sir Adam Beck, E. L. Cousins, Toronto; W. B. Burgoyne, St. Catharines; W. M. German, K.C., Welland; W. H. Breithaupt, Kitchener; O. E. Fleming, K.C., and W. C. Kennedy, M.P., Windsor; G. A. Graham, Fort William; W. S. Bowden, Goderich; Hon. Sidney Story, New Orleans; C. P. Craig, Duluth; and W. H. Adams, Detroit, may be mentioned.

The chair was occupied by F. A. Nancekivell of Windsor, who in his speech laid down these bases for action: "The world's markets are being realigned; and if we are to have prosperity we must reach out for foreign trade both in our natural and manufactured products. And, if we are to compete with other countries for world trade, we must keep down our costs of production and delivery. Transportation charges on raw material and finished products constitute quite a large percentage of the cost to the ultimate consumer. Therefore, any saving effected in such charges will yield big results both in foreign and domestic trade. Water transportation, as everyone knows, is much cheaper than rail transportation; and, when we consider what a wonderful natural system of inland waterways is the joint heritage of Canada and the United States, and how comparatively little is necessary to be done in addition to that already done, to give us a deep waterway from the Atlantic tidewater to the head of the Great Lakes, then surely, now is the time to get behind the project and push it through."

C. P. Craig, known as the "Father" of the deep waterway movement in the United States, made the following points: "It is a great thought to create on this continent an American Mediterranean which will be to this wonderful country what the Mediterranean has been to Europe; but it is just as great a thought and one just as inspiring to think of two great nations joining together to do this common thing for a common good." "The way to the sea, opening our front door to the sea," was his answer to the problem of higher freight rates. The electric power of the St. Lawrence if properly utilized would, he maintained, save 36,000,000 tons of coal a year. Other speakers were R. J. Maclean, Detroit, and F. H.

Keefer, who strongly supported the scheme and described the power section of it as the greatest ever proposed.

Sir Adam Beck stated that by deepening the Welland Canal from 25 to 30 feet and the St. Lawrence at one or two points, 90 per cent. of all ocean-going vessels in the world would be able to traverse the Great Lakes freely. "The power possibilities of the St. Lawrence are unexceeded anywhere," he said. "For four years, the Ontario Hydro-Electric Power Commission has had a skilled staff of engineers and investigators in constant research and investigation, collecting information and data regarding the possibilities of this development. At Cedar Rapids from 160,000 to 180,000 h.p. can be developed. It is advisable to deepen the St. Lawrence at this point or the power development will be imperilled. At Morrisburg and the Long Sault Rapids, perhaps 1,000,000 h.p. can be produced. From the waters of Lake Ontario 200,000 h.p. can be developed and probably 200,000 h.p. more between the borders of Ontario and Montreal." He estimated $100,000,000 as the cost of the Great Lakes and St. Lawrence River development and the coal saved in the power part of the scheme as 100,000,000 tons.

An organization was then formed called the Canadian Deep Waterways and Power Association with W. M. German, K.C., Welland, as Hon. President; Sir Adam Beck and Mayor T. L. Church, Toronto, as Hon. Vice-Presidents; O. E. Fleming, K.C., as President; and F. Maclure Sclanders, F.R.G.S., Windsor, as Hon. Secretary-Treasurer. Resolutions were unanimously passed as follows:

(1) That one of the objects of this Association shall be to act in conjunction with and co-operate with the Great Lakes-St. Lawrence Tidewater Association, and any other like organization having similar objects in carrying on the work that we deem urgent and most essen-

tial to this country—the opening up of the natural waterways from their head to the tidewater on the St. Lawrence River; and to facilitate and cheapen transportation and power development;

(2) That this Association is of the opinion that the work to be undertaken in the deepening of the natural watercourse for ocean-going shipping should be undertaken by the Government of the United States and Canada jointly, and that it should be operated as a joint undertaking so far as the watercourses may be international; that the water powers of the St. Lawrence should be developed to their fullest extent for the purpose of producing a revenue—such revenue to be used to provide a sinking fund for the retirement of the capital expenditure, payment of interest and maintenance and operation of the canal system and hydro-electric operation; and that in this way, in our opinion, the project should be made self-supporting.

This movement, and the desire of the Ontario Hydro-Electric Power Commission for right to develop some of the St. Lawrence water powers in order to electrify railways and to assist the industries of Ontario, did not find favor in Quebec, and the project was claimed to involve large sums of money for the purchase or possible elimination of already established power interests in the St. Lawrence. The Dominion Government believed that the problem, being international and interprovincial, would require Federal control; that a deepened waterway would have to be constructed as well as the power development because the friends of the project in the United States wanted their chief lake cities to become ocean ports. The plan decided upon was to refer the subject to the International Joint Commission for study and report, following upon certain technical details which had been officially looked into by United States and Canadian experts; and were reported upon at the close of the year.

Intimately and closely associated with the natural resources of Canada and their development during 1920 were her great waterway systems. It was realised that vast pos-

sibilities lay in power production; that this meant the cheapening of industrial products through an adequate supply of heat and light; it foretold cheaper transport for grain and a shorter route from the west to Liverpool; while the whole question touched the fringe of international relations at various points.

The estimated undeveloped horse power of Canada's waterways in 1920 was 19,260,000, with about 40 per cent. of this available in populated areas and also 2,417,000 h.p. in actual use. Electrical projects involving over 1,000,000 additional of hydro-electric horse power were well under way. In January, 1919, there were in Canada 795 central electric stations with 1,841,114 h.p. developed representing a capital investment of $401,942,402, with a revenue from the sale of power of $53,549,133, and operating expenses of $30,265,866.

All the greater industrial centres were provided with hydro-electric power; other centres could be created or aided by the application of new energy. Of these latter the greatest was the St. Lawrence River. According to a pamphlet published in this year by Arthur V. White, a recognized authority, the resources of the river were as follows:—

Site	Head available	Estimated low water 24-hour h.p.	Average 24-hour low water h.p.
Morrisburg Rapide Plat	11-15 ...	170,000—230,000 ...	200,000
Long Sault Rapids	30-40 ...	500,000—650,000 ...	575,000
Coteau Rapids	15-17 ...	230,000—260,000 ...	250,000
Cedars Rapids	30-32 ...	490,000—525,000 ...	500,000
Split Rock and Cascades Rapids	14 18 ...	220,000—280,000 ...	250,000
Lachine Rapids	20-30 ...	300,000—450,000 ...	375,000
Total		1,910,000-2,395,000	2,150,000

Canada had already spent some $90,000,000 on the St. Lawrence River in canalization and deepening of the channel, and in the House of Commons on April 23, the Hon. C. C. Ballantyne, Minister of Marine and Fisheries, stated that $20,000,000 more would he required to complete the 35 foot channel from Montreal to the sea. The estimated cost of deepening channels and canals to admit ocean steamers passing up into the Great Lakes and entering the harbors of Toronto, Port Arthur and Fort William in Canada, or Duluth, Detroit and Chicago in the United States, was $150,000,000. Canada and the United States had already spent over $100,000,000 in the Lake Erie and Ontario connection alone.

In 1919 a pronounced agitation had sprung up in both countries to connect all the Great Lakes ports with ocean navigation. The movement began in the organization of the Canadian Deep Waterways and Power Association in the Dominion and the Great Lakes-St. Lawrence Tidewater Association in the United States. It originated partly from the Georgian Bay Canal agitation of preceding years in Canada, and it had a wider vogue through Congressional discussions as to American lake cities and ocean shipping. It was strongly supported in the western states and in Ontario, although it met with much opposition in New York State and in Montreal.

The proposed improvements of the St. Lawrence River fell into two sections: (1) in the 118 miles of international boundary waters running from Lake Ontario to Cornwall and St. Regis and (2) in the 67 miles of Canadian waterway from Cornwall and St. Regis to Montreal.

Early in 1920 the International Joint Commission, to which body Sir William Hearst, K.C., lately Prime Minister

Hudson Bay
PROVINCE OF ONTARIO
PROVINCE OF QUEBEC
MINNESOTA
WISCONSIN
MICHIGAN
ILLINOIS
INDIANA
OHIO
PENNSYLVANIA
NEW YORK
VERMONT
NEW HAMPSHIRE
MAINE
MASSACHUSETTS
CONNECTICUT R.I.
NEW BRUNSWICK
NOVA SCOTIA
PRINCE EDWARD ISLAND
NEWFOUNDLAND
CAPE BRETON ISLAND
LAKE SUPERIOR
LAKE MICHIGAN
L. HURON
L. ST. CLAIR
L. ERIE
L. ONTARIO
LAKE NIPISSING
GEORGIAN BAY
GULF of St LAWRENCE
ATLANTIC OCEAN
St. Lawrence River
Ottawa River
St. Maurice River
Saguenay River
Hudson River
Ohio R.
Allegheny Mountains
Canada U.S.A.
PORT ARTHUR FORT WILLIAM
DULUTH
Bruler R.
Amnicon R.
Moose R.
St Croix River
Keweenaw Waterway
Keweenaw Point
MARQUETTE
SAULT STE. MARIE
Soo Canal
Lake George
BRUCE MINES
St Marys Falls Canal
Hay Lake
NEEBISH ISLAND
SUDBURY
NORTH BAY
Lake Nipissing
French River
Turtle Lake
Trout Lake
GREY
MIDLAND
PORT SEVERN
COLLINGWOOD
BARRIE
Nottawasaga
Jacks Lake
L. Simcoe
LINDSAY
Burgoyne Lake
PORT PERRY
KING
Lake Scugog
Humber Riv
TORONTO
TRENTON
KINGSTON
Bay of Quinte
Murray Canal
Welland Canal
Lake Ontario
Rideau Canal
Kingston
Ottawa
Lake Rideau
PERTH
BERWICK
Carillon Rapids
Milles Isles
Lake St. Peter
SOREL
ST. OURS
VARENNES
ST. ROSALIE
ST HYACINTHE
CHAMBLY
Chambly Canal
ST JOHNS
CANADA UNITED STATES
MAPS
SEE DETAIL (25) (26)
Lake Champlain
Richelieu River
L. Maskinonge
Grenville Canal
HAWKESBURY
MONTREAL
QUEBEC
CHAUDIERE JCT.
PLATON
LOTBINIERE
BATISCAN
FATHER POINT
TADOUSSAC
RIVIERE DU LOUP
Saguenay River
Strait of Belle Isle
NEW FOUNDLAND
GULF of St LAWRENCE
PRINCE EDWARD ISLAND
MONCTON
SHEDIAC
PICTOU
CAPE BRETON ISLAND
ST ANDREWS
SAINT JOHN
TRURO
VICTORIA BEACH
WINDSOR
HALIFAX
NOVA SCOTIA
SABLE ISLAND
PORTLAND
Kennebec River
SALEM
MEDFORD
BOSTON
PROVIDENCE
NEW YORK
BROOKLYN
PHILADELPHIA
WHITEHALL
Champlain Canal
WATERFORD
ALBANY
TROY
Mohawk R.
Erie Canal
ROME
UTICA
LITTLE FALLS
ITHACA
MONTOUR FALLS
Seneca R.
Seneca and Cayuga Canal
OSWEGO
Oswego R.
Rondout
HANNIBAL
Clyde R.
ROCHESTER
OLCOTT
LOCKPORT
Niagara Falls
Welland Canal
Lewiston
Tonawanda
BUFFALO
Lake Erie
Chautauqua Lake
Conneaut
ERIE
Presque Isle
Grand River
Cuyahoga R.
CLEVELAND
AKRON
MASSILLON
ZOAR
BRECKSVILLE
NEW COMERSTOWN
CUMBERLAND
DRESDEN
Muskingum R.
MARIETTA
PITTSBURGH
WHEELING
ELIZABETH
Ohio R.
CINCINNATI
DAYTON
SIDNEY
LORAMIE
PORT JEFFERSON
Miami Canal
INDIANAPOLIS
TERRE HAUTE
Maumee R.
DEFIANCE
JUNCTION
TOLEDO
DETROIT
Detroit River
WINDSOR
ST THOMAS
Thames R.
LONDON
BRANTFORD
HAMILTON
GALT
KITCHENER
GODERICH
GRAND RAPIDS
ANN ARBORO
BENTON HARBOR
MICHIGAN CITY
CHICAGO
LOCKPORT
JOLIET
LASALLE
PEORIA
ROCKFALLS
Green R.
STERLING
Rock R.
Mississippi R.
Illinois and Mississippi Canal
Illinois and Michigan Canal
Chicago Sanitary & Ship Canal
Chicago Drainage Canal
Des Plaines R.
Illinois R.
MILWAUKEE
PRAIRIE DU SAC
Wisconsin R.
PORTAGE
L. Winnebago
Fox R.
MONTELLO
GREEN BAY CITY
DEPERE
Sturgeon Bay
Sturgeon Bay & L. Michigan Ship Canal
Manistique
Mackinac
St Mary's R.
St Joseph Channel
St Clair R.
St Clair Flats Canal
Lake St Clair
Detroit R.
Lake Erie
Niagara R.
Welland Canal
Lake Ontario
Oswego R.
Rondout
Hudson River
Lake Champlain
Richelieu River
Saguenay River
St. Maurice River
Ottawa River
Lake Nipissing
French River
Georgian Bay
Lake Huron
Lake Michigan
Lake Superior
Lake Erie
Lake Ontario
Lake St. Peter
Lake St Clair
Lake Scugog
Lake Rideau
Lake Champlain
Lake St Peter
Lake Maskinonge
Lake Rideau
Lake Scugog
Lake St Clair
Lake Erie
Lake Ontario
Lake Nipissing
Lake Simcoe
Lake Winnebago
Lake Michigan
Lake Superior
Lake Huron
Lake Erie
Lake Ontario
Lake St Clair

of Ontario, had been appointed in succession to Mr. Mignault, the latter having been transferred to the Supreme Court at Ottawa, entered upon an active study of the situation under instructions from the Governments of Canada and the United States; and the reference included the following questions:

(1) Upon what basis should the capital cost of the completed improvements be apportioned as between Canada and the United States?

(2) Upon what basis should the costs of operation and maintenance be apportioned to each country?

(3) What method of control is recommended for the operation of the improved waterway in order to secure its most beneficial use?

(4) Will regulating Lake Ontario increase the low water flow in the St. Lawrence ship channel below Montreal and if so to what extent and to what additional cost?

(5) To what extent will the improvement develop the resources, commerce and industry of each country?

(6) What traffic, incoming and outgoing, in kind and quantity, is likely to be carried upon the proposed route both at its inception and in the future? Consideration to be given not only to present conditions, but to probable changes resulting from the development of industrial activities due to availability of large quantities of hydraulic power.

The reference as a whole and from the engineering point of view involved consideration of four methods or plans: (1) by means of locks and navigation dams in the river; (2) by means of locks and side canals; (3) by a combination of the two preceding methods; (4) by means of locks and power dams. The channels to be considered were of 25 to 30 feet depth at low water, and outline plans and preliminary estimates were to be submitted based upon Welland Canal enlargements and Niagara Falls power development. The general scheme was to show: (1) the best means of improvements looking to navigation alone and (2) the most efficient way of utilizing the St. Lawrence River for power purposes. As the handling and disposal of ice was a fundamental diffi-

culty on the river the arrangements necessary for this purpose were to be discussed.

Following the receipt of these instructions, the International Joint Commission met in New York on February 13, 1920, and arranged for a series of sittings in American and Canadian cities to hear argument on the proposed international improvements. The first meeting was held at Buffalo on March 1 and 2, when large delegations for and against the project were present. Mr. Gardner, in opening the proceedings, said that the fate of the proposals must rest upon the commercial value of the enterprise measured against the cost. The commission at this stage had no prejudices for or against; it did not know yet whether the plan was "sane or insane." Although the commission was composed of three Canadians and three Americans, its decisions had so far been unanimous, and he believed it afforded a practical example for the League of Nations in the amicable settlement of international questions: "Our deliberations have always been distinguished by a spirit of give-and-take and compromise," he said. "The commission has settled a number of cases along the boundary, some of which bore the seeds of international trouble, and so unobtrusively that a large number of people had not been aware of its existence."

The Hon. S. A. Dempsey of New York City, with powerful backing from corporate, Erie Canal, railway and political interests, addressed the commission in opposition to the scheme. He contended that such a deep waterway would be impracticable, as, on account of ice troubles, it could be navigated only by steamers of special construction. He foresaw international complications in case of war in which either Great Britain or the United States might be involved. More-

over, Buffalo, Philadelphia, Baltimore and New York would receive no advantages from the plan even if it were otherwise a success.

Frank M. Williams, a civil engineer representing the State of New York, said that such canals were not necessarily effective in solving transportation problems. The eastern terminus of the proposed waterway would be Montreal, which was ice-bound for five months in the year, while New York was open every day. He protested against any scheme which would depreciate the State of New York's investment of $200,000,000 in the Erie Canal, and alleged that the funds for the St. Lawrence canalization would have to be found largely by the taxpayers of New York.

Henry W. Hill, ex-Senator, was the leader of the New York forces, and in his statement he described the scheme as being "radical, speculative and enormously expensive." He was not opposed to an international agreement as to the power question alone but, he added, "the oil and coal interests have not been heard from."

In the press and in discussions during the sittings, considerable feeling was expressed as to the whole matter being a Canadian scheme to get aid from United States monetary interests. Mr. Gardner, as chairman, however, brushed aside such statements by pointing out that the origin of the project was in the House of Representatives at Washington.

J. H. Finley, a Washington electrical engineer, described what he thought electrical development would do for the eastern states: "I can see the time not far distant," he said, "when all the railroads, all the manufacturing interests and all the lighting requirements of the people will be supplied by electrical energy." His opinion was that the international

waterways of the St. Lawrence were capable of developing 2,000,000 h.p., and that the value of the power developed would carry the whole cost of canalization.

The Canadian viewpoint was expressed by W. D. Gregory, representing the Ontario Government; R. S. Gourlay, the Toronto Harbor Commission; J. M. Campbell, President of the Kingston Board of Trade: A. C. Garden of Hamilton, and A. C. Lewis, M.L.A., of the Canadian Deep Waterways and Power Association. The latter spoke strongly: "The assumption that the benefits of water transportation to the markets of Europe are the inalienable right of the Atlantic seaboard, and that the central and western sections of these two countries should be forever hampered by the excessive cost of long rail hauls, cannot any longer be suffered."

Early in May, 1920, the commission began its Canadian tour. At North Bay on May 7, A. J. Young said that the St. Lawrence plan would be of no value to the northern country without a canal from Lake Nipissing to Georgian Bay by way of French River. Such a canal could produce 30,000 h.p. of electrical energy. Arthur A. Coles, mining engineer, spoke of the enormous mineral and forest wealth of the north. There would be an abundance of freight for transportation; gold production then had a value of $10,000,000 a year; the annual output of lumber was about 100,000,000 feet of pine, 350,000 cords of pulpwood and nearly 2,000,000 ties.

At Sault Ste. Marie on May 10, a comparison of distances was presented by L. S. Sabin, Superintendent of the St. Mary's Falls Canals. By the St. Lawrence route the distance from the Sault to Liverpool would be 4,128 miles; by the Erie Canal route it was 4,549 miles, and by the

Oswego-Mohawk route, 4,641 miles. The sailing time for an average cargo steamer would be 16 days 15 hours by the St. Lawrence and 19 days 15 hours by either of the other routes. The total shipping passed through the Sault canals in 1916, a record year, had been 91,000,000 tons. The total shipping in New York harbor during 1927 was 57,000,000 tons.

All the testimony heard at Sault Ste. Marie and also at Marquette, Mich., was strongly favorable to the St. Lawrence route proposals. An important point was made in a joint report from the Board of Trade and the City Council of the Sault by the statement that the two great local industries, the Algoma Steel Corporation and the Lake Superior Paper Company, could bring in certain raw materials much cheaper by boat than at the present time. The completion of the St. Lawrence scheme would open the coalfields of the Maritime Provinces to the industries at the head of the lakes. It would benefit industry by enabling the shipment of steel products eastward in boats which could bring back the large quantities of coal required; it would make possible the fuller utilization of a vast quantity of low grade ores existing in the district; the cheaper transportation would ensure the establishment of an industry for refining pyrites which was now shipped to the seaboard for this purpose.

At Fort William, the commission received a memorandum prepared by the Boards of Trade and City Councils of Fort William and Port Arthur. After reciting the advantages that would result from the full use of the 30 miles of deep water dockage available at these ports, the document concluded: "Considering the immense traffic of the lakes and the future possibilities of development for our transportation facilities, we believe that the making of these two harbors into ocean

ports will do much to push forward the economic and financial growth of Canada and the United States."

A note of opposition was sounded at Winnipeg on May 15. Mayor Charles F. Gray considered that the more immediate need for the west was the completion of the Hudson Bay Railway to tidewater on the north. This would cost about $4,000,000 as compared with what he described as a possible expenditure of $400,000,000 for the St. Lawrence project. W. A. Milner, Secretary of the Winnipeg Board of Trade, claimed that the returns from the deeper waterways would not be commensurate with the cost and stated that, in the opinion of the organisation he represented, the saving in freight rates would not exceed 1½ cents on a bushel of grain.

T. R. Deacon, recently appointed Vice-President of the Canadian Deep Waterways Association for Manitoba, doubted if sufficient information concerning the project was available for western business men to enable them to form an intelligent opinion.

Calgary was visited by the commission on May 22, but no detailed information was available; the surrounding municipalities, councils and boards of trade had not studied the question.

From Calgary the commission proceeded to Montana and Wyoming and, in the United States during the early part of June, held sittings in Wisconsin and Michigan. At Ottawa on October 6 an alternative scheme was presented by John Bingham, President of the Ottawa Board of Trade, and Noulan Cauchon, consulting engineer. The plan was to connect the Ottawa River and the St. Lawrence by a deep canal with terminals near Ottawa and at Cardinal. It was contended that fewer locks would be necessary; that the cost

would be less than the St. Lawrence project by $100,000,000, and that 2,000 square miles of swamp lands in eastern Ontario would be reclaimed. As to the question of developing electrical energy along the St. Lawrence, it was contended that Canada could not use all the power which would be produced and, consequently, it would be exported to the United States to the disadvantage of the Dominion.

Montreal was visited on October 8 and 9. The Board of Trade, the Shipping Federation and the Harbor Commissioners gave evidence which had an unfavorable tendency. It was claimed by some witnesses that ocean vessels could not be profitably employed on inland waterways and that for this reason they regarded the deepening of the St. Lawrence waterways as mainly to the advantage of lake vessels carrying heavy cargoes to tidewater. Others expressed strong objection on the ground of expense.

W. G. Ross, Chairman of the Harbor Commissioners, urged improvement of the present St. Lawrence canal system and other waterways to the extent of facilitating the access of large lake boats to the port of Montreal. "My commissioners are strongly of the opinion that no further hydro development of power on the St. Lawrence should be permitted until an ultimate plan has been decided on and developed that will satisfy Canadian interests and safeguard the navigation of the St. Lawrence," he said. As to the development of power, the Montreal witnesses expressed warnings against allowing such energy to be controlled by private interests.

George Sumner, President of the Board of Trade, presented the following resolution:

That the canalization of the St. Lawrence waterway is both desirable and inevitable and that this important work should be undertaken by the Government as soon as the finances of the country justify the necessary heavy expenditure it will involve; that in view of the water power which such canalization work will render available and the need of such power for the further development of our manufacturing industries it is most necessary that any scheme of deepening the St. Lawrence waterway should include provision for power production and that such power should not be allowed to pass into private hands but be entirely under Government control; that as ocean vessels cannot be profitably employed on inland waters and as lake vessels are unsuited for ocean travel, it is necessary that the latter should be enabled to reach the ocean port so as to avoid transfer of their cargo to smaller craft and, therefore, that the inland waterways should be all of sufficient depth to permit of the largest lake vessels reaching Montreal.

R. Wilson Reford, President of the Shipping Federation, submitted a memorandum expressing opposition to the proposal because it would interfere with the water level of the St. Lawrence; because there was no complete plan yet prepared; and because it would mean a costly deepening of all the approaches to canals and a dredged channel from Montreal to Lake Ontario and up the Detroit and St. Clair Rivers with the rebuilding of the Welland and Sault Ste. Marie Canals to a depth of 30 feet. It was said that transportation under these expensive conditions, coupled with ice difficulties, would not be economical; it was asserted that the scheme emanated from private companies who were seeking to create and control large water powers, and it was described as being of vastly more benefit to the United States than to Canada. The cost was placed at $200,000,000; and the Georgian Bay Canal was deemed to be more desirable.

At the hearing in Kingston, Sir Adam Beck presented a memorandum to the commission in which he asserted that the potential power value of the chain of waterways from

Sault Ste. Marie to Montreal was about 4,500,000 h.p., equivalent to 90,000,000 tons of coal per annum. He stated that deep draft navigation and power development were inextricably bound together. "Canada and the United States," he said, "must make provision for developing the immense latent power resources of the St. Lawrence River, and they must formulate their plans without delay if a serious check in industrial development is to be avoided."

All the other interests heard in Kingston and in Toronto were favorable to canalization, but there was a lack of definite and clearcut testimony in the latter city. Mayor T. L. Church and E. L. Cousins gave some vigorous testimony; the former stated that Toronto had been saved $20,000,000 through Ontario's hydro-power; that further power developments on the St. Lawrence canals would bring enormous benefits to industry and to agriculture both in Canada and the United States; that every year electrical energy, the equivalent of $400,000,000 worth of coal, was going to waste in the St. Lawrence; that the finest system of inland waterways on the continent was lying idle because deep draft vessels could not pass through a 48 mile section of the St. Lawrence River. T. A. Hollindrake of the Canadian Manufacturers' Association stated that coal and steel could be brought from Sydney if a sufficient depth were given in the river to enable bulk cargoes to come up to the Great Lakes.

The commission was in New York on October 19, 20 and 21, and there Emil P. Albrecht of Philadelphia, stated that in case of war between Great Britain and the United States an American investment in the St. Lawrence improvement scheme would be imperilled and, he added, "if Canada wants this canal let her pay for it." During the hearing

strong opposition was expressed regarding the project with arguments based largely upon its alleged economic unsoundness. It was contended that traffic would be largely one way; that lake vessels were unsuitable for sea voyages, and that marine insurance would be very costly because of hazards in the St. Lawrence River.

On the other side of the question were Herbert C. Hoover, W. C. Redfield, lately United States Secretary of Commerce, Julius H. Barnes, Admiral W. S. Benson, W. L. Saunders, President of the American Manufacturers' Association, J. R. Howard, President of the American Farm Bureau Federation, and many leaders in finance and trade from the west. The friends of the project argued that it would reduce the cost and expedite the movement of United States grain exports and thereby widen the farmers' margin of profit. The necessity of developing hydro-electric power in order to conserve the coal supply of the United States was said to be of outstanding importance, while the continued congestion of transportation lines between the east and west, and the clogging of New York piers month after month with import and export freight would, it was claimed, be avoided.

Meanwhile, the Canadian Deep Waterways and Power Association had been active. A convention was held at Winnipeg on January 28, 1920, with one hundred delegates present, and an address was given by O. E. Fleming, in which he stated that the deepening of the waterways meant a saving of 5 cents a bushel on western wheat. The $5,000,000 to $7,000,000 to be gained in this way each year would, he pointed out, be sufficient to pay interest on the project. He also stated that United States supporters were pledged to go into the scheme

on the basis of 50 per cent. of the cost of building and maintenance.

At Brockville on October 7, Major Lewis, Secretary of the Canadian Deep Waterways and Power Association, stated that the project meant $9.00 power and a city of 50,000 people. The local Board of Trade warmly approved the policy.

At Toronto on November 10, Mr. Fleming gave it as his opinion that $70,000,000 worth of coal imports yearly could be saved by utilizing power from the St. Lawrence. River.

The annual meeting of the Canadian Deep Waterways and Power Association was held in Toronto on December 17, and resolutions were passed calling upon the Dominion Government to speed up the Welland Canal improvements; also, to endorse the scheme for deepening the St. Lawrence River at the earliest possible moment. United States Senator Lenroot said that there was only one way to bring the Atlantic to the Great Lakes and that was by deepening the St. Lawrence River. United States railway congestion between Chicago and the east would then be relieved. In 1920 Canadian farmers would have saved $20,000,000 in the transportation of their wheat crop; millions of dollars would be saved to consumers in both countries because every city on the lakes would have the same advantages as coast cities now had. Referring to the Great Lakes-St. Lawrence Tidewater Association, the Senator said: "Fourteen states on our side of the line have banded together as an association to put the project through and this year intend to raise the sum of $175,000 for educational work."

Dr. T. Kennard Thompson, a distinguished New York engineer, presented a scheme of combined private capital with

Government control at a cost of not over $100,000,000, as follows:

> If the two Governments will agree to a common sense contract which would give the Governments control of the design, construction, operation, selling price of power, collection of taxes, and provide a commission to be paid, a private corporation for furnishing capital, doing all the work and selling the power, then the two Governments would be able to get ample draft for ocean-going vessels to the Great Lakes, get 6,000,000 h.p. a year, and build up undreamed-of manufacturing interests, resulting in unheard of prosperity for the whole continent, without the expenditure of a single cent, except a trifling amount for supervision, which would be as nothing compared with the taxes collected.

Earlier in the year (1920) a booklet had been issued by the Canadian Deep Waterways and Power Association which enumerated a number of outstanding advantages to Canada from the realization of the waterway scheme, namely, (1) reduction of freight rates; (2) elimination of transfers; (3) elimination of shortages in eastern elevators; (4) retention of identity of grain shipped; (5) elimination of shrinkage and resultant reduction in quantity on account of the numerous necessary transfers in eastern elevators; (6) elimination of delays to shipments on account of waiting for ocean space.

One rather important objection to the project was now beginning to make itself increasingly felt in both countries. In Canada it was said that any international control of, or cooperative action in connection with, the St. Lawrence River would prejudice Canada's power over its greatest waterway to the sea in case the United States were at war with some power allied with or friendly to Canada and the British Empire. In this claim there were points deserving of serious consideration.

Opponents in the United States also raised a similar point, although a very small portion of the river touched Ameri-

can soil. F. M. Williams, State Engineer of New York, in his annual report for 1919-1920, went so far as to assert that "the St. Lawrence project will take the control of the waterway out of the hands of the United States!"

HISTORY OF THE NEGOTIATIONS OF THE ST. LAWRENCE WATERWAY PROJECT, 1832-1929 (1)

Second Period, 1921-1922

During 1921 the International Joint Commission, in its study of the question of deepening and developing the St. Lawrence River, had many schemes submitted to it. Early in the year the two engineers (2) attached to the commission submitted a report favorable to a general deepening of the waterway between Lake Ontario and Montreal from an engineering point of view. They suggested a scheme which involved the building of nine locks, a 33 mile canal of 25 foot depth, and developing 1,464,000 h.p. of electricity, at a cost of $252,728,200.

Under this plan the waterway would consist of a combination of lake, river, canal and locks, and power and navigation dams, two of the important canals having a width of 300 feet. This scheme, it was said, would agree with the regulation of desirable levels in Lake Ontario and in the St. Lawrence River, and permit an increased flow in the latter during low water periods. The principal power plants would be at Lake St. Louis, Morrisburg and Iroquois, and the proposal was that the cost of the project should be divided between

(1) *The Canadian Annual Review of Public Affairs,* 1919, and subsequent volumes.

(2) W. A. Bowden, Chief Engineer of the Department of Railways and Canals, represented Canada, and Lieut.-Colonel W. P. Wooten of the Corps of Engineers, United States Army, represented the United States.

Canada and the United States. It was claimed that the revenue from water power alone would pay for the entire project in a few years.

G. S. Williams of Ann Arbor, on behalf of the Great Lakes-St. Lawrence Tidewater Association, proposed a scheme which included nine locks, seven dams and 4,000,000 h.p. of electricity, at a cost of $750,000,000; $300,000,000 being for navigation purposes, and $450,000,000 for developing horse power.

U. S. Connolly, representing the New York and Ontario Power Company, Waddington, N.Y., presented plans providing for a series of dams from Waddington to Morrisburg, developing 660,000 h.p., with a second series of dams at the Long Sault, developing 1,000,000 h.p. The cost of the first development was placed at $36,000,000 and the second at approximately $65,000,000.

While receiving and considering these and other plans, the commission was meeting at various points in Canada and the United States. At Detroit on March 31, Congressman O. J. Larson of Minnesota, stated that the proposed waterway would add $300,000,000 a year to the value of the farm produce of the United States, while Canadian farm produce would increase in value by $44,000,000 a year. H. J. Hughes, personal representative of the Governor of Minnesota, told the commission that he represented about 50,000 organized farmers of his state with business interests in St. Paul, Minneapolis and other cities, and voiced unqualified approval of the project. At the same time a convention of the Great Lakes-St. Lawrence Tidewater Association, representing fifteen states, met in Detroit and expressed renewed confidence in the undertaking.

On July 10, under the auspices of the same association, one hundred men prominent in the political and business life of the United States visited Niagara Falls as guests of the Province of Ontario. They made a tour of the proposed route of the international deep waterway, and two days were given to an inspection of the hydro-electric undertakings centred upon the Falls. At St. Catharines on July 11, Sir Robert Borden welcomed the party, which he afterwards described as perhaps the most important American body that had ever come to Canada.

The new Welland Canal was visited, and the delegation was in Toronto on July 12, and heard an address by Sir Adam Beck, after which they started down the lake and river to Rochester, Ogdensburg, Montreal and Quebec. The object of the trip was to convince the delegates that (1) the two nations could actually combine to deepen the channels between tidewater and the Great Lakes sufficiently to increase and cheapen water carriage from the wheat countries to the sea; and that (2) there could be a joint exploitation of the water powers running to waste in the St. Lawrence River.

Much favorable opinion was expressed. A Chicago journal, *Power Plant Engineering,* said in August that the project would save the United States 100,000,000 tons of coal a year, and $18,000,000 on the transportation of wheat alone; it would be the remedy for American freight blockages and help to check excessive railway rates. *The Toronto Daily Star,* and Toronto interests generally, favored the plan for some, at least, of the reasons that Montreal and New York opposed it. It would make Toronto a seaport and its harbor a hive of transportation development, and the newspaper in question estimated (September 16) a saving on

freight rates upon the Great Lakes alone of $31,000,000. The scheme should save from 8 cents to 10 cents a bushel on all grain raised in the districts tributary to the Great Lakes, and this saving would amount annually to about the cost of the improvements proposed.

The Ontario Hydro-Electric Power Commission reported in November that the St. Lawrence would yield over 4,000,000 h.p. of electricity, of which 1,600,000 was in the international portion of the river, with 800,000 h.p. belonging to Ontario. If this latter amount were available to-day (1921) it could all be utilized within a relatively brief period. On the assumption that power would be available in five years, the commission estimated a demand for nearly 3,000,000 h.p. within the present decade, and more than 6,000,000 h.p. before 1941, in addition to the present demand.

The Globe, Toronto, stood vigorously for the project, and on November 21 stated that: "The deepening of the St. Lawrence canals is inevitable. The weight of public opinion behind the project is irresistible. New York and Montreal have not power enough to prevent the 20,000,000 people who have built their homes and carry on business on the border of the Great Lakes from using to the full the great advantage of water transportation."

In the United States Congress on December 5, a debate took place on the project with A. P. Nelson, Wisconsin, and W. W. Chalmers of Ohio, both Republicans, in favor; and A. J. Griffin, Democrat, with F. C Hicks, Republican, both of New York, against the proposal. A. P. Nelson stated that: "On the grain produced within the territory affected there would be a saving of $350,000,000 annually, and it may be conservatively estimated that the producers of the United

States will be benefited to the extent of at least $500,000,000, in return for a total expenditure of less than $150,000,000, which will be reimbursed to the Government in full by the revenue derived from water power." Incidentally, W. W. Chalmers, stated that the power station would be within the territory of the United States close to the Canadian line and only 170 miles from Boston.

At the close of the year 1921 it became known that the International Joint Commission had decided to recommend to Parliament and to Congress the scheme of its engineers, which would cost the two countries $252,000,000 to carry out.

Meanwhile, the Canadian Deep Waterways and Power Association had met in Hamilton on November 1. Hugh Blain, Toronto, criticized the attitude of Montreal and claimed that as the Federal Government had expended upwards of $57,000,000 on the harbor there, and on the St. Lawrence River below Montreal, that city should not object to the project even if it did specially benefit Toronto. He urged that the project would be a means of developing Canadian resources, and that it would bring about a readjustment of freight rates.

Mayor C. G. Coppley of Hamilton, stated that his city was behind the scheme. H. T. Harriman, President of the New England Power Company, Boston, claimed that grain could be shipped by the improved waterway from the head of the Great Lakes to Boston for 6 cents or 7 cents a bushel compared with the current cost of 2 cents from Fort William to Buffalo, and 12 cents from there to the Atlantic seaboard.

In Montreal, the Board of Trade in its 1921 report, reaffirmed its view and support of the Shipping Federation of Canada by an elaborate declaration that:

(1) Navigation interests on the St. Lawrence required all the available depth of water between Montreal and the sea, and this might be interfered with by the proposed dams and power plants;

(2) The cost was greatly under-estimated and would amount to at least $200,000,000 for a 20 foot channel;

(3) For a 30 foot channel the cost would be enormous;

(4) From an economic point of view it was improbable that ocean-going vessels would ever make a practice of trading to ports on the Great Lakes, no matter to what extent the canal systems were enlarged and deepened, as the cost of upkeep of ocean steamers, the delay in proceeding through the canals, and the danger of damage, would be too great to make them a revenue paying proposition;

(5) Canals should not be built internationally, and that those in Canada should be constructed and owned by the Dominion Government;

(6) The proposed power action would be of little benefit to Canada as Ontario had immense water powers awaiting action of which Canada would have the entire production;

(7) The proposed development would be of vastly more benefit to the United States than to Canada, and that it would be better for the Dominion Government to adopt the Georgian Bay Canal scheme as cheaper, more beneficial and all-Canadian;

(8) The state of the finances of the Dominion made the plan unwise and especially so in view of the fact that canals along the border were free of toll.

In New York, Governor Nathan L. Miller vigorously opposed the project. He feared international complications and delay in current developments at Niagara and in the St. Lawrence itself; also, he preferred private rather than public effort in such a connection, and advocated state development of its own resources as the first consideration. State transportation interests drew attention to their own facilities, and especially the New York State Barge Canal which,

it is claimed, gave established rates, through bills of lading, insurance on cargoes, free store delivery at Buffalo, transfer allowances in the port of New York, and had working agreements with both lake and ocean transportation lines. It was claimed, as in Montreal, that it was not economical to send large ocean-going steamers the long trip up river, canal and lake to lake ports.

E. H. Outerbridge, chairman of the Port of New York Authority, in a letter published during September, claimed that:

(1) The final costs would run up to $1,000,000,000;

(2) Navigation of the St. Lawrence River was open only seven months of the year;

(3) The canal would be useless unless lake ports and channels were deepened to 30 feet at an enormous cost;

(4) Insurance rates on the St. Lawrence River were higher than for Atlantic ports, and especially so in the autumn and spring;

(5) The operating cost of ocean steamers through such a canal under the most favorable circumstances would be greater than the cost of transporting grain through elevators to ocean ships at a real ocean port;

(6) As a power proposition, even if justified on economic grounds, it was not one to which the United States Government should pledge its credit or spend the money of the people;

(7) Since private individuals had not displayed any willingness to furnish capital for the canal it was apparent that faith in it was lacking;

(8) It had none of the justifications of the Panama Canal in cutting off enormous distances between the various states, with its possession a matter of naval and military protection of the country's coasts.

The Boston Chamber of Commerce in March issued a statement that the project was not practicable from an engineering point of view, nor necessary as an economic consideration. It claimed, as did New York opponents of the scheme,

that Massachusetts, Pennsylvania and New York, would bear the bulk of the taxation involved.

The project for improving transportation facilities on the St. Lawrence River, and for developing its power resources by international action, continued under active discussion during 1922. The water power available in the Dominion at this time was estimated at 18,755,316 h.p., and the turbine installation in 1921 was 2,756,600 h.p. This development represented an investment of $500,000,000, and its product the annual equivalent of 18,500,000 tons of coal. To Canadians without central resources of coal, therefore, power questions were of vital importance; certainly as much so as the problem of cheaper transportation, or that of railways versus waterways. The St. Lawrence question touched both problems, and the general basis upon which international action was urged was briefly that:

(1) A channel 25 feet in depth at low water in the river between Montreal and Lake Ontario, would enable the greater proportion of vessels engaged in British and foreign trade, practically all vessels engaged in Canadian and United States coastwise trade, and most of those calling at the 30 foot harbors of the Atlantic coast, to enter the Great Lakes;

(2) Every increase of navigation facilities on the Great Lakes had brought benefits amounting to many times the cost, and a future outlay, such as proposed, would be a high grade investment bringing similar or greater returns to the public of two nations;

(3) All but a small proportion of the vessels using the Panama and Suez Canals, or calling at New York, could, at a 25 foot depth, navigate the St. Lawrence;

(4) So far as America was concerned, there was in its rich interior section contiguous to the Great Lakes, a large proportion of the surplus agricultural and mineral products of the country; that the manufactured goods of this area went all over the world, and that existing rail haul of 1,000 to 1,500 miles, and attendant costs and delays, were a serious handicap upon United States trade which the St. Lawrence development would remove;

(5) In both countries the waterway would remove the cost and delay of freight transfers; would lower the rates on western grain by 8 cents or 10 cents a bushel, and, in this way alone, would cover the cost of the improvements; also, it would enable the St. Lawrence waterway to carry commerce amounting to 20,000,000 tons within a short period after completion, and would remove the evils of United States railway congestion at certain periods;

(6) The electric power possibilities were enormous, with (in 1921) a total primary installation power in the United States 300 mile area of the St. Lawrence approximately 9,900,000 h.p., and on the Canadian side 1,900,000, with an estimated American demand in 1925 of 11,000,000 h.p., and Canadian requirements in 1925 of 2,350,000 h.p.;

(7) It would, through water power development, create a vast industrial business which in turn would enlarge the traffic of the waterway, and help to meet the cost of both transportation and power development, conserve coal supplies, and aid in the electrification of railways;

(8) As to restricted navigation facilities hampering ocean vessels, modern lake freighters had found no difficulty in navigating the St. Mary's River; that restricted channels were common to many seaports, and that there was no essential difference between navigating inland and similar channels along the sea coast;

(9) As to harbors, all the chief lake cities were willing and ready to do their part in preparing facilities for ocean-going vessels—notably Toronto, Chicago, Duluth, Milwaukee, Detroit, Hamilton and Toledo;

(10) New York, from which such strong opposition came, had not improved its terminals to cope with the ever-growing commerce of the United States, and it did not seem probable that it would ever do so in adequate form;

(11) Congestion of railways in the United States; delays in transportation of freight; the country-wide injury to products and goods; the national losses from delay in business, made the waterway imperative;

(12) The scheme would save the Canadian west $30,000,000 a year in freight on grain by a reduction of at least 5 cents a bushel on lake freight, with a corresponding advantage to the American west.

The international development of the St. Lawrence River was not popular in Quebec because it promised to open up Great Lakes harbors and ports, and Toronto in particular,

as competitors with Montreal for ocean traffic. It was viewed with suspicion in New York because the position of the New York waterways, such as the Erie Canal, was threatened, and the port's supremacy invaded. It was popular in the American west, where the States of Ohio, Indiana, Illinois, Wisconsin, Michigan, Iowa, Minnesota, North and South Dakota, Nebraska, Colorado, Montana, Wyoming and Idaho, were interested in agricultural shipping facilities. It was not so popular in the Canadian west, where only Saskatchewan sent a representative to the hearings of the International Joint Commission; while Quebec, Manitoba and Alberta, absented themselves entirely from official discussions.

On January 16, 1922, the International Joint Commission reported unanimously on their investigation of the St. Lawrence Waterway project. The report, as published by the two Governments, reviewed the physical nature of the problem; the possible advantages and disadvantages; the opinions of those who gave evidence in Canada and in the United States; the areas; population; commerce and business tributary to the St. Lawrence; railway and waterway conflicting interests, and international conditions.

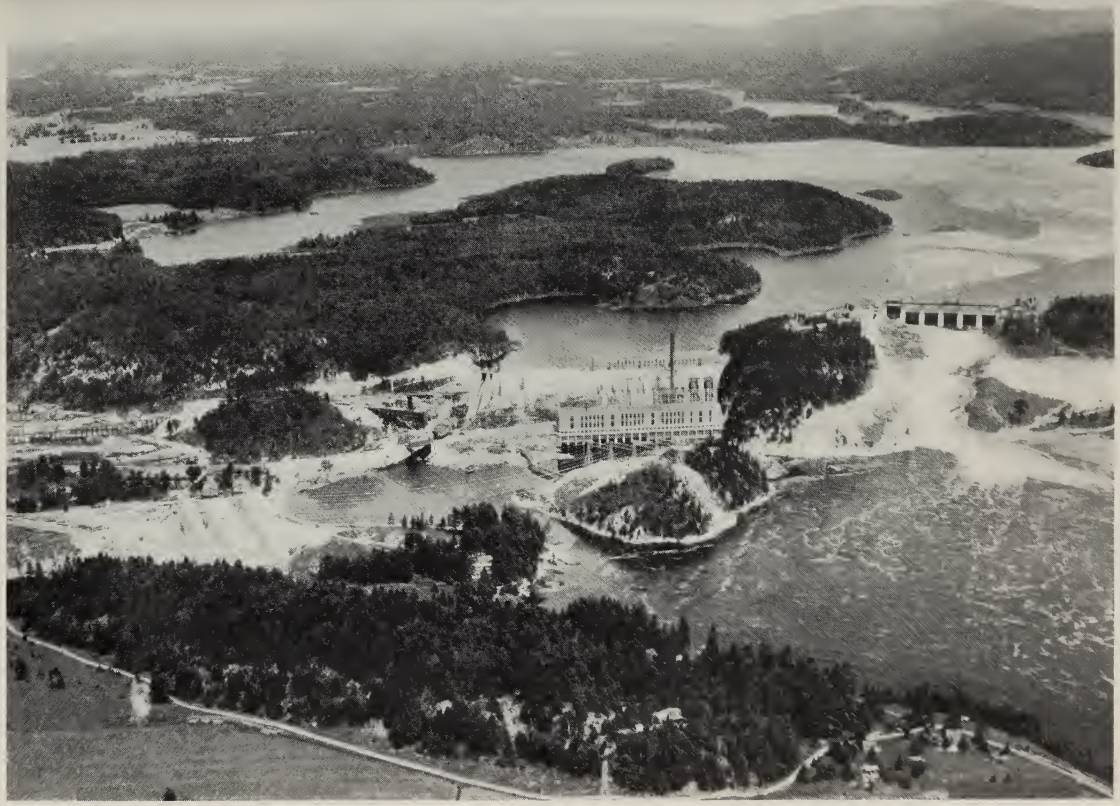
It will be remembered that the commission had been asked to investigate, consider and report as to (1) what further improvement in the St. Lawrence River between Montreal and Lake Ontario was necessary to give navigation for deep draft vessels of lake or ocean-going type; and (2) what depth of water was necessary, what would be the cost, and what the benefit in respect to power interests?

An examination of the report discloses the fact that the main points of difference between those who advocated and those who opposed the project before the commission were,

as to whether ocean-going ships could or would use the deep waterway if it were constructed, and whether there would be sufficient cargoes outbound and inbound to make the route a success and to justify the considerable expense involved in its improvement.

Included in these major questions were many other points of difference, such as the effect of the limited season of navigation on the lakes, and on the St. Lawrence; ice conditions; fog; restricted channels; limited depths in inland waters and insurance rates; competition between lake freighters and ocean craft; the necessity of deepening connected channels and harbors, and harbor facilities on the Great Lakes, and on the seaboard; the time factor as affecting voyages to and from the head of the lakes, and the possibility of developing waterborne traffic between lake ports and Atlantic or Pacific coast ports; the possible influence of the new route in stimulating existing avenues of production and creating new ones; ship canals versus barge canals, rail versus water transportation, and the effect of the water route on railroad congestion; ocean rates and inland water rates; bulk freight and package freight problems on the Great Lakes; relative cost of building and operating ocean ships and lake vessels, and the characteristics of each; practicability of a composite type of vessel adapted to both ocean and lake traffic; shipbuilding on the Great Lakes; grain movement to the seaboard and transhipment charges and losses; natural resources of the region tributary to the Great Lakes; its industrial development; banking facilities, etc.

The commission's report, a document of 184 pages with a number of maps, may be summarized briefly as follows. It found that:



Power development at Paugan Falls on the Gatineau River, Province of Quebec

Official photograph, Royal Canadian Air Force

(1) Of the various alternative routes from the interior to the sea none offered advantages comparable with those of the route by way of the St. Lawrence;

(2) Without considering the probability of new traffic created by the opening of a water route to the seaboard, there exists to-day (1922) between the regions economically tributary to the Great Lakes and overseas points, as well as between the same region and the Atlantic and Pacific seaboards, a volume of outbound and inbound trade that might reasonably be expected to seek this route sufficient to justify the expense involved in its improvement;

(3) Because of the wider areas and population served, the benefits derived will (at first) accrue in much larger measure to American than to Canadian interests;

(4) Experience had demonstrated not only the tremendous importance of water communication to the foreign commerce of any country, but also the manifest advantages of linking up rail and water routes;

(5) As the new Welland Canal, now nearing completion on the Canadian side, was the only other link in addition to the projected St. Lawrence improvements, necessary to a deep water route from the head of the Great Lakes to the sea, its cost should be included in any international St. Lawrence scheme.

The recommendations of the International Joint Commission may be summed up as follows:

(1) That the Governments of Canada and the United States should enter into an arrangement by way of treaty for a scheme of improvement of the St. Lawrence River between Montreal and Lake Ontario, and that Canada, meanwhile, should complete this in accordance with present plans;

(2) That the proposed works between Montreal and Lake Ontario be based upon the report of the Engineering Board accompanying the commission's report at the estimated cost of $252,000,000, to which should be added the cost of the Welland Canal improvements, *but that before a final decision be taken the Engineering Board should be enlarged and should make a further investigation of the whole subject;*

(3) That such navigation works as lay wholly within one country, and were capable of economic and efficient construction, maintenance and operation, as complete and independent units, be maintained and operated by the country in which they were located, with the right of

inspection by an international board to ensure economy and efficiency; that navigation works not filling these requirements should be placed under the international board on which each country would have equal representation;

(4) That the cost of all navigation works be apportioned between the two countries on the basis of the benefits each will receive from the new waterway;

(5) That the cost of navigation works for the combined use of navigation and power, over and above the cost of works necessary for navigation alone, should be apportioned equally between the two countries.

There was wide public discussion of the project throughout the year 1922. Moreton Frewin, an English writer, stated in the London press that the British expenditure of $25,000,000 on the Assouan Dam in Egypt, had increased the available tax revenue of that country by $25,000,000 a year. He expressed the belief that the International Joint Commission's plan for deepening and improving the St. Lawrence River might yield a yearly revenue a thousandfold greater, and he advised a joint international arrangement with Great Britain guaranteeing Canadian bonds for the required cost.

In Washington, the project was discussed at various times by the Senate and the House of Representatives. W. W. Chalmers presented in the House a measure authorizing the improvement on the part of the United States, but stipulating that the expense be borne equally by Canada and the United States through a bond issue guaranteed by both Governments, not upon the basis of benefits to be derived.

The New York Congressmen and Senators fought the waterway project with vigor, and Senators W. W. Calder and J. W. Wadsworth urged the President in person to hold back any favorable recommendation until further reports became available. However, President Harding sent the report

of the International Joint Commission to Congress with a strongly favorable statement:

> I have spoken of the advantage which Europe enjoys because of its access to the sea, the cheapest and surest transportation facility. In our own country is presented one of the world's most attractive opportunities for extension of the seaways many hundred miles inland. The heart of the continent, with its vast resources in both agriculture and industry, would be brought in communication with all the ocean routes by the execution of the St. Lawrence Waterway project. To enable ocean-going vessels to have access to all the ports of the Great Lakes would have a most stimulating effect upon the industrial life of the continent's interior.
>
> The feasibility of the project is unquestioned and its cost, compared with some other great engineering works, would be small. Disorganized and prostrate, the nations of central Europe are even now setting their hands to the development of a great continental waterway which, connecting the Rhine and Danube, will bring water transporation from the Black to the North Sea, from the Mediterranean to the Baltic. If nationalistic prejudices and economic difficulties can be overcome by Europe, they certainly should not be formidable obstacles to an achievement less expensive, and giving promise of greater advantages to the peoples of North America.

An alternative scheme was presented to the House by D. A. Reed of New York. It proposed to authorize the Hudson Ship Canal Company to build a channel 30 feet deep and 200 feet wide from Seneca Shoals, near Lackawanna, to Olcott Harbor on Lake Ontario, an all-American route. W. B. McKinley in the Senate appealed to that body to break the bonds on the "land locked middle-west" by construction of the St. Lawrence Waterway, and he stated that the whole transportation system of the country must be reorganized with the projected waterway as the key to the reconstruction programme. The New York State Barge Canal was said to be entirely inadequate and unable to cope with one-twentieth of the freight that moved from the middle-west to the seaboard.

Senator Calder opposed the St. Lawrence plan; he estimated its immediate cost as $500,000,000 with an ultimate expenditure of $1,450,000,000, and he stated that the project was of no value for the purpose of carrying Canadian wheat to the sea. C. E. Townsend, Michigan, replied by saying that: "Canada could not under any circumstances profit as much as the United States, her railroads afford ample transportation facilities and we are short of railroad transportation." He went on to claim that "the fumbling hands and greedy fingers of the political organization that controls New York harbor have built barriers to the streams of commerce which impose a deadening burden upon industrial effort," and he followed up his speech with a series of articles in the middle-west press adducing proof as to these contentions.

Meanwhile, the report of the International Joint Commission was referred to a committee which advised, but not unanimously, that the United States Government should proceed to negotiate a treaty with Canada. The United States Administration through Secretary C. E. Hughes, notified the Canadian Government that it was willing to begin negotiations with a view to arranging a treaty for joint action with the object of deepening the St. Lawrence Waterway. The despatch was received and forwarded to Ottawa by the British Ambassador, and the reply of the Canadian Government was handed by Sir Auckland Geddes to the United States Secretary of State.

In his original despatch Mr. Hughes summarized the findings of the International Joint Commission and then added: "I venture to suggest further that, if it should not be deemed desirable to formulate, in the first instance, a treaty embracing a complete plan for the execution and the financing of

the project, it might be practicable to conclude a treaty pledging the two Governments to undertake the execution of the project on the basis of the recommendations submitted by the International Joint Commission, or such modifications as might be agreed upon, and making provision for a joint commission with the duty of formulating such a complete plan, which should be subject to the approval of the two Governments prior to the beginning of the work of construction."

The declination of the Canadian Government was a somewhat unique thing in the relationship of the two countries. According to Premier Mackenzie King in the House of Commons, the situation was a simple one : "The Government," he stated, "has replied to the effect that the present is not an opportune moment to take the matter up; that there has not been sufficient time to consider the report that has been presented, and that for the time being, considering the magnitude of the project and of the expenditure involved, the matter should be allowed to remain in abeyance."

In the meantime, various private interests and public bodies had been discussing the subject. Civic and commercial organizations throughout the State of New York joined a Waterways Committee in a campaign to bring the value of the New York State Barge Canal to the attention of shippers in the middle-west and adjacent states. Attention was drawn to the fact that the canal had cost New York State $165,000,000, and that it had a capacity of 20,000,000 tons with only 10 per cent. of this utilized.

The following is a list of some of the organizations and interests which in 1921 and 1922 reported themselves as being in favor of international joint action:

CANADIAN

Border Cities Chamber of Commerce
Bowmanville Chamber of Commerce
Brantford Chamber of Commerce
Bruce Mines Board of Trade
Canadian Deep Waterways and Power Association
Canadian Manufacturers' Association (Toronto)
Collingwood Chamber of Commerce
Cornwall Board of Trade
Dominion Marine Association
Dunnville Board of Trade
Eastern Ontario Municipal Power Union
Fort William Board of Trade
Galt Board of Trade
Goderich Board of Trade
Hamilton Board of Trade
Hamilton Harbor Commission
Kingston Board of Trade
National Waterways Association of Canada
Ontario Hydro-Electric Power Commission
Port Arthur Board of Trade
St. Catharines Chamber of Commerce
Sault Ste. Marie Board of Trade
Toronto Board of Trade
Toronto Harbor Commission
Western Ontario United Boards of Trade
Windsor Chamber of Commerce

AMERICAN

Akron Chamber of Commerce
Chicago Association of Commerce
Chicago Board of Trade
Chicago Clearing House Association
Cleveland Chamber of Commerce
Denver Civic and Commercial Association
Des Moines Chamber of Commerce
Detroit Board of Commerce
Detroit Transportation Association
Duluth Board of Trade
Farmers' Union of Nebraska
Grand Rapids Association of Commerce

Illinois Manufacturers' Association
Indiana Manufacturers' Association
Indiana Public Service Commission
Indiana State Chamber of Commerce
Indianapolis Chamber of Commerce
Institute of American Meat Packers
Kansas City Chamber of Commerce
Michigan Federation of Women's Clubs
Milwaukee Association of Commerce
Milwaukee Civic Association
Minneapolis Civic and Commerce Association
Minnesota Federation of Farm Bureaux
Minnesota Federation of Farmers' Clubs
Minnesota Livestock Breeders' Association
Minnesota Railroad and Warehouse Commission
Mississippi Valley Association
Montana Livestock Commission
Nebraska Farmers' Elevator Association
North Minnesota Development Association
Ohio Farmers' National Grain Association
Omaha Chamber of Commerce
Omaha Grain Exchange
St. Paul Traffic Association
South Dakota Development Association
South Dakota Federation of Farm Bureaux
South Dakota Grain Dealers' Association
Springfield Chamber of Commerce
Terre Haute Chamber of Commerce
Toledo Commerce Club
Toledo Produce Exchange
United States Farmers' National Grain Dealers
Wisconsin Railroad Commission

In nearly all these centres, and many others not mentioned above, the municipal councils supported the deep waterway project. On the other hand, opposition was not so conspicuous nor so active nor so well organized, but it was influential and important. The only American state that officially opposed international action was New York,

although a good deal of antagonism was expressed in other Atlantic states. In Canada, Quebec was almost a unit against the proposal.

Among the American organizations opposed to the project were the following:

Albany Chamber of Commerce
Atlantic Deep Waterways Association
Boston Chamber of Commerce
Bronx Board of Trade
Brooklyn Chamber of Commerce
Buffalo Chamber of Commerce
Buffalo Corn Exchange
Buffalo Lumber Exchange
City Club of New York
Hudson Valley Federated Chamber of Commerce
Joint New England Commission of Foreign and Domestic Commerce
Maine Commission of Foreign and Domestic Commerce
Merchants' Association of New York
New York Produce Exchange
New York State Chamber of Commerce
Philadelphia Board of Trade
Philadelphia Bourse
Philadelphia Commercial Exchange
Portland Chamber of Commerce
Providence Chamber of Commerce
Rhode Island Commission of Foreign and Domestic Commerce
Troy Chamber of Commerce

The only Canadian organizations of importance opposed to the project were:

Montreal Board of Trade
Montreal Chamber of Commerce
Montreal Harbor Commission
Shipping Federation of Canada

Their objections may be summarized as follows:

(1) That sea-going ships must earn money on a large initial cost; long drawn out voyages in waters of restricted depth, and in narrow channels, would be bound to result in financial loss;

(2) That the economic ocean vessel was one of about 30 foot draft, and to accomodate a boat of this size all the present lake harbors and river channels would have to be deepened to something over 30 feet;

(3) That lake vessels could carry wheat on the lakes cheaper than ocean vessels; but, on the other hand, they were not built to stand the storms of the high seas;

(4) That the foundation of success in seaports was multiplicity and frequency of overseas shipping lines and inland transportation routes, as well as extensive clearing house facilities, and that these conditions would not prevail at lake ports;

(5) That ocean vessels could not afford to use the St. Lawrence route because there would be few, if any, full cargoes from overseas points to lake ports;

(6) That, from the national standpoint, it was not desirable that canals in Canadian territory should be built or controlled internationally, and largely for the benefit of American interests;

(7) That similarly, from the American point of view, American money needed for the development of purely American waterways should not be diverted to an international scheme which, it was said, would be mainly for the benefit of Canada;

(8) That ocean navigation on the Great Lakes would be seriously affected by (a) the speed retarding and dangerous conditions of fog and ice in the lower St. Lawrence River and Gulf; (b) shallow depths and tortuous or, at least, an irregular channel layout, even after improvement, necessitating slow speed for large vessels; (c) time lost at locks; (d) heavy marine insurance; (e) short navigation season of about seven months; (f) a largely one-way traffic; (g) a restricted market;

(9) That as to power development, the cost would be prohibitive; that there was no market for such power in eastern Ontario, nor in the Montreal district, which were already supplied from other sources; that available water powers in the State of New York and on the Ottawa, St. Maurice and other rivers in Canada, could be more economically developed than those of the St. Lawrence;

(10) That over 60 per cent of Canadian wheat was exported through United States ports, and why, therefore, should Canada spend one-half of $252,000,000 to provide better navigation on the St. Lawrence when, as a matter of fact, the river was actually not receiving the traffic that its navigation facilities entitled it to?

Opposition to the St. Lawrence Waterway project continued to make itself felt, and a commission appointed by the Governor of New York to fight the scheme filed with the Legislature a report condemning it on the grounds that:

(1) Insufficient data and inaccurate estimates only were available;

(2) It proposed to surrender New York vested rights in St. Lawrence water powers;

(3) The water powers in question belonged to the Canadian provinces, or to the State of New York, and not to the Dominion or United States Governments;

(4) The cost of the project would be at least $448,000,000.

The Governors of two states, H. J. Allen of Kansas and N. L. Miller of New York, debated the subject at Washington and Chicago. Mr. Allen said that the project would give great power supplies to the eastern states and added: "It is not a question of cost, but it is a question of giving to 43,000,000 Americans the use of a perfectly possible enterprise."

The American Steamship Owners' Association appointed a special New York committee to investigate the project, and the Great Lakes-St. Lawrence Tidewater Association urged support on the ground that: "The Canadians, single handed, are spending something like $60,000,000 on the new Welland Canal, which is as much, relatively, as six or seven billions would be for us, and there may be a limit somewhere to the public spirit of that Empire-minded people. It should be noted, also, and to their further credit, that the Welland Canal when completed, will be free to the ships of the United States."

Governor J. A. O. Preus of Minnesota, speaking in Ottawa, said that: "Canada is far more interested in the waterways plan than we are. Canada will have an increasing grain output on cheaper land than we can provide in the

United States. Canada is interested not only in the water route but also in the water power which would be secured." He referred to the great population of eighteen states, from the Alleghenny Mountains to the Rockies, as having a bearing on the situation. To ship a ton of iron from Duluth to Boston cost $22.77 by rail and $5.55 by water. "A few years ago," he stated, "we built the Panama Canal at a cost of $400,000,000, and that is of no use to the middle-west. Ten times the tonnage passes through the "Soo" Canal in its open season as goes through the Panama Canal in the whole year."

To people in Canada, the St. Lawrence schemes proposed by the Ontario Hydro-Electric Power Commission were of local interest. There were three of them: (1) a single-head development concentrating the entire available fall at the foot of the Long Sault Rapids—where the main dams and power house would be placed, with a control dam at the Rapide Plat to regulate the outflow from Lake Ontario—with a product of 1,492,000 continuous horse power of electricity at a cost of $141,696,192; (2) a double-head development, including the fall in the Galop Rapids and the Rapide Plat, and the fall at Farran Point and the Long Sault, with two power houses and dams, and a product of 1,600,000 h.p., at a cost of $154,092,512; (3) a modification of the second scheme with a development of 1,635,000 h.p. costing $154,925,415.

Ontario's special interest in the project was presented to the International Joint Commission by Sir Adam Beck, in a memorandum which described the policy of his power commission as being "to complete first the development of all available power at Niagara; then to join the Federal Gov-

ernments of Canada and the United States in the development of the international water powers on the St. Lawrence; and finally, to develop the water powers on the Ottawa River." The intention was to link up these great main sources of power by means of an inter-connected transmission network, which would embrace also such of the smaller water powers as could advantageously be included in the main schemes. He estimated that, after the Chippewa Canal project was in operation, 56 per cent. of the total available power at Niagara would have been absorbed.

In various speeches throughout the year, Sir Adam Beck took occasion to urge the importance of the St. Lawrence Waterway project, especially from the power point of view. At London, Ont., for instance, he said that results could be had under St. Lawrence development equal to those of the Niagara zone. A 220,000 volt high tension transmission line could be built from the St. Lawrence power stations to Toronto; Ontario's 1,200 miles of lake shore would become so much ocean coast line, with the deep waterways scheme completed. He pictured motor trucks as feeders to a great radial system, the radials in turn acting as feeders to the railways, or ocean-going ships docking at Toronto, Port Stanley and other lake ports. *The Toronto Daily Star* and *Globe* vigorously supported the project, and the former newspaper claimed that it would make 1,800,000 h.p. of electricity available in the international portion of the river of which Ontario would be entitled to 800,000 h.p., or an equivalent of 6,000,000 tons of coal yearly.

In the Canadian Parliament the project was discussed during a debate upon T. L. Church's motion declaring that:

The Government of Canada should give early and favorable consideration to the report of the International Joint Commission on the St. Lawrence Waterway and request the Government of the United States to join with Canada in making the international agreement for carrying out the work so recommended.

Mr. Church claimed the project to be as important as that of Confederation or the Canadian Pacific Railway; he gave a history of national work upon the St. Lawrence as a waterway; he estimated enormous benefits to Canada along the lines of cheaper transportation, developed industry and conservation of coal supply; he described great advantages which would accrue to Ontario in particular.

The Hon. Fernand Rinfret of Montreal, strongly opposed the project on the grounds that it meant an immense increase in Canadian obligations; that the cost would be at least $400,000,000, of which Canada would bear one-half; that it was largely an electrical power question to its Canadian supporters and not one of transportation; that Canada could not use its power if obtained, and that "this partnership with the United States would involve innumberable causes for possible conflict."

John Miller and J. L. Brown (Western Progressives), E. A. Lapierre and F. S. Cahill (Liberals), opposed the motion, with the Hon. R. J. Manion (Conservative) speaking in its favor, and describing the project as "a magnificent monument of international amity and good understanding between the United States and Canada." In the Senate the Hon. J. P. B. Casgrain severely criticised the proposal and claimed that great engineers estimated the cost at $1,300,000,000, and he quoted R. M. Wilson of Montreal, who had developed 124,000 h.p. at Cedars, Que., as stating that the

production of horse power under the St. Lawrence scheme would cost $300 to $325 per horse power.

It was claimed by Senator Casgrain that the great number of locks in the proposed waterway would make rapid and economic transportation impossible. There were in the proposed scheme, from Montreal to the Great Lakes, 28 locks. Successful canals had either only one or two locks, or were on sea level. Other difficulties of navigation were pilotage, the Detroit River and the St. Clair Flats. The scheme would also necessitate the expenditure of millions of dollars in deepening lake ports. He also stated that the damming of the St. Lawrence would flood an area of 29,000 acres at present covered with valuable farms and villages, while other towns and villages would have to be protected by immense and costly dykes.

The Ontario Legislature unanimously approved a resolution, moved by Major A. C. Lewis, stating that:

> The Legislature hereby affirms its belief in the wisdom, from a commercial and economic point of view, of improving navigation facilities of the St. Lawrence River, so as to permit ocean vessels drawing up to 25 feet of water to enter and navigate the Great Lakes; and also to undertake the development of the power at present wasting in the St. Lawrence River rapids.

As regards Quebec, a note of opposition was forthcoming in a statement by the Hon. L. A. Taschereau, the Premier, that his province was opposed to the scheme; that of the 4,100,000 h.p. which it was proposed to develop or put in a neutral zone, two-thirds were in Quebec, and that his province would not consent to alienate its rights.

HISTORY OF THE NEGOTIATIONS OF THE ST. LAWRENCE WATERWAY PROJECT, 1832-1929 (1)

Third Period, 1923-1927

During 1923 the various attitudes of the different parts of Canada and the United States towards the question of deepening the St. Lawrence River, and the development of its power resources, underwent little change. Ontario, and those parts of the New England states which were in need of power, supported the proposal, as did most of the middle-west states and the western provinces of Canada; while New York, Montreal and Buffalo continued their opposition. Supporters of both points of view were more or less efficiently organized; the issues were kept actively before the public mind and, although no final decisions were made, there were some developments of sufficient importance to mention briefly.

Early in the year it was reported from New York that the Super-Power Corporation of Buffalo had made requests to the Federal Power Commission at Washington for two permits to develop the St. Lawrence River at the towns of Waddington and Messina, N.Y. The extent of generating was to be 600,000 h.p. and 1,000,000 h.p.; 920,000 h.p. to be marketed in the United States and the balance of 680,000 h.p. to be reserved for Canadian use. The plans contemplated the improvement of the river along the lines of the proposed St. Lawrence Waterway project, to include locks designed for a draft of 30 feet.

(1) *The Canadian Annual Review of Public Affairs,* 1919, and subsequent volumes.

It was estimated that the combined power and navigation scheme would cost $211,466,419, and the plants were to be in the United States at Ogden Island and at Barnhart Island. The capacity of the Ogden Island plant was placed at 700,000 h.p., the intention being to develop 600,000 h.p. continuously; 420,000 h.p. to be absorbed by the United States, and the remainder to be disposed of in Canada. The installed capacity of the Barnhart Island plant was estimated at 1,000,000 h.p., to be shared equally by Canada and the United States. The plans were laid on a large scale, and it was anticipated that it would take ten years to carry them into effect.

Ontario regarded this plan with apprehension. It was argued that a cheaper and more plentiful supply of power was sought by the textile industries of New Hampshire, Massachusetts and Rhode Island, to enable them to compete successfully with their rivals situated further to the south, and nearer to the supply of raw materials. Ontario could not be expected to be interested in the domestic issues across the border. What concerned that province was that she owned all the surplus waters on the Canadian side of the international boundary not required by the Federal Government for navigation purposes. The accepted policy of the Ontario Government was to hold in reserve all the latent power of the waters under its control, to be developed later by the Ontario Hydro-Electric Power Commission as trustee for the municipalities of the various power districts.

The Provincial Government was, therefore, determined that no private monopoly should obtain a foothold on the north shore of the St. Lawrence River. In addition, Sir Adam Beck, the chairman, had pointed out that there would soon be a serious shortage of power in eastern Ontario, and

he informed the Ontario municipalities that they could develop St. Lawrence power on their own credit, without even provincial guarantee of the bonds. Ontario, with no coal, was largely dependent upon the goodwill of America for a supply. It was, therefore, essential that her "white coal" should not be alienated in such a way as to permit American industrialists to force Canada to share her electrical energy with the citizens of Boston and New York. The Hon. E. C. Drury, Premier of Ontario, on enquiring at Ottawa, was assured that the Dominion would not alienate water-power on the St. Lawrence River without the province's sanction and co-operation.

Whether any one of the schemes that had been submitted from time to time was to be wholly or partly taken up was a matter of conjecture, but it was becoming increasingly apparent at this time that the development of power on the St. Lawrence was receiving earnest consideration. The opposition of the city of Montreal was indicated by frequent editorials in its newspapers, which were invariably antagonistic in sentiment.

Throughout the year 1923, Sir Adam Beck repeatedly predicted a shortage of power in the near future, and he viewed with dismay the waste of energy in the waters of the St. Lawrence. He opposed any further early development of Niagara power, and he advocated action in demanding from Ottawa a clear recognition of the rights of the province in regard to the ownership of streams furnishing water power.

In September word was received from Washington that the St. Lawrence Waterway project was being given favorable consideration. The Committee on the Development of

Waterways and Co-ordination of Rail and Waterway Service, a body appointed by the United States Chamber of Commerce, had examined the matter and reported itself as being convinced that the plan should be carried out.

President Coolidge, in his message to Congress at the opening of the session in December, called attention to the needed improvement of the waterways from the Great Lakes towards the Gulf of Mexico, and to the development of the power and navigation possibilities of the St. Lawrence River, for which "efforts are now being made to secure the necessary treaty with Canada."

Continuing his message, President Coolidge said:

> These projects cannot all be undertaken at once, but all should have the immediate consideration of Congress and be adopted as fast as plans can be matured and the necessary funds become available. This is not incompatible with economy, for their nature does not require so much a public expenditure as a capital investment which will be reproductive, as evinced by the marked increase in revenue from the Panama Canal. Upon these projects depend much future industrial and agricultural progress. They represent the protection of large areas from flood, and the addition of a great amount of cheap power and cheap freight by use of navigation, chief of which is the bringing of ocean-going ships to the Great Lakes.

This statement led to a conference at Ottawa during the last few days of the year, at which the Dominion Government was represented by Premier Mackenzie King and the Hon. Charles Stewart, and the Ontario Hydro-Electric Power Commission by Sir Adam Beck. The Premier was reluctant to pronounce definitely upon the matter. His attitude was due partly to the opposition to the project that was coming from Quebec, and partly on account of the vast expense involved at a time when Canada was trying to balance her national budget.

Premier Taschereau, a few days before this conference took place, had announced that he was frankly and definitely opposed to the deepening of the St. Lawrence above Montreal. He asked: "On what principle should the moneys of our province be devoted to an enterprise entirely detrimental to Montreal, its great metropolis. Why favor a project which would place, at least partially, under foreign control, the exclusive jurisdiction which we now exercise over our great river, and such hydraulic developments as the future may hold " These remarks elicited from *The Globe,* Toronto, the reply that: "The Premier of Quebec may rest assured that it will be impossible to make a maritime Verdun of the St. Lawrence. The great river is the property, for purposes of navigation, not of the Province of Quebec, but of all the people of the United States and of Canada. It is their will that must determine the extent of its use."

During 1924 the St. Lawrence Waterway project continued to receive its due share of official and public attention. Premier Taschereau took an early opportunity to renew his opposition. Speaking in the Quebec Parliament during the first week in January, he said:

> And, if Montreal is to profit from the enormous hydraulic forces which run at its doors, I hope that never will there be constructed on the St. Lawrence such works as will affect the flow, and take from the port of Montreal the place which it occupies among the maritime cities of the continent. That would be a national crime. As concerns the Government of Quebec, I can assure the people of the metropolis that the last judgment of the Privy Council on the ownership of river beds has given us a formidable arm. Works of this nature within the limits of the province require our concurrence. I am not ready to say that such concurrence is already acquired. I beg the other provinces not to see in our attitude the least desire to harm them, but have we not the imperious duty of protecting our Quebec patrimony? The sister provinces, in turn, would do the same thing. If, however, these

works can be carried out without prejudicing our interests in any manner, we have nothing to say except that the old Province of Quebec, which is the richest province to-day because it knows how to economise, is not desirous to see additional millions added to the heavy federal debt, and which debt Quebec is called upon to meet in large measure. Never has economy been more necessary than to-day, for in a young country such as ours, too high taxation paralyzes progress and stops initiative.

In March, the Governments of Canada and the United States decided to enlarge the personnel of the Joint Engineering Board—the official designation of the Canadian and American engineers who were attached to the International Joint Commission, and whose report the commission decided to adopt in its recommendations. This board now consisted of six members instead of two, as follows:

Canada

D. W. McLachlan, Department of Railways and Canals (Chairman);

O. O. Lefebvre, chief engineer Quebec Streams Commission, Montreal;

Brig.-General C. H. Mitchell, Toronto.

United States

Major-General Edgar Jadwin (Chairman);

Colonel William Kelly;

Lieut.-Colonel George B. Pillsbury.

Comprehensive and explicit instructions were given to this enlarged board to review the engineering problems of the whole question; the formulation of possible alternative schemes; revision of the estimates; effect on water levels, regulation of the flow of water; effect of the Chicago diversion; power development; division of national and international work, etc. It was desired that the board should report by the end of April, 1926, but in reply to a question in the House of Commons on

February 8, the Hon. Charles Stewart, Minister of the Interior, stated that it was the expectation of the Canadian section that the report would not be made before July.

Speaking at Winnipeg in November, Brig.-General Mitchell, a member of the Joint Engineering Board, said: "The present situation with respect to the St. Lawrence Waterway project finds the citizen and public bodies in both countries still in some confusion. Like all great projects of such magnitude and with so many angles of view, it takes a long time and much discussion to crystallize public opinion to the stage when definite action can be taken. It can hardly be said that public opinion in either country has yet reached that state of crystallization, but it appears to be not far off."

On the ground that she desired to preserve her independence of action, Canada declined to entertain the suggestion of any further international body of enquiry. This led the President of the United States to appoint the St. Lawrence Commission, an entirely American body representative of such of the eastern and western states as were interested in and affected by the project. The members were:

Hon. Herbert C. Hoover, Secretary of Commerce, (Chairman);

William C. Breed, New York;

James E. Davidson, Bay City, Mich.;

James P. Goderich, Winchester, Ind.;

James R. Howard, Chicago;

James D. Noonan, American Federation of Labor.

Shortly afterwards, the Canadian Government announced the appointment of a National Advisory Committee, consisting of:

Hon. G. P. Graham, Minister of Railways and Canals, (Chairman);
Thomas Ahearn, Ottawa;
Hon. W. E. Foster, Saint John, N.B.;
Beaudry Leman, Montreal;
Edward D. Martin, Winnipeg;
Dr. W. L. McDougald, Montreal;
Sir Clifford Sifton, K.C., Toronto;
Major-General John Stewart, Vancouver;
Hon. Adelard Turgeon, Quebec.

No advance was made in the general negotiations concerning the project during 1924, although further enquiries were conducted into such questions as feasibility and cost. The antagonism of Quebec continued to make itself felt; Ontario and the near west were friendly; while the far west was looking rather for an outlet to the Pacific coast. These various influences had their effect on the Government and caused it to hesitate before coming to any decision. *The Gazette,* Montreal, in dealing with the attitude of that city towards the project, said on July 2:

> As a matter of fact, there has never been a considerable sentiment in Montreal against the deepening of the waterway, and certainly none on the part of the shipping interests founded upon the notion that the business of the port of Montreal would be put in jeopardy. The project has been questioned on two grounds: one, the great cost involved; the other, the importance of placing the waterway under joint jurisdiction with the United States; and it has been pointed out that the expectation of lake ports becoming terminals of ocean vessels is futile. Montreal takes neither a narrow nor a selfish view of the subject. No apprehension has ever been felt that ocean ships will use canals. What happened when the Lachine and Welland Canals were enlarged will happen again. The lake vessels will come to meet the ocean steamers at Montreal ,and whatever increase in trade may be brought about will benefit this port.

The special investigations inaugurated in 1924 by the Governments of Canada and the United States, with a view to the ultimate development of the St. Lawrence River as an international waterway, were carried on throughout 1925 by the various bodies entrusted with this work. Besides the National Advisory Committee, Canada appointed an Inter-Departmental Committee, composed of technical officers from various Government Departments at Ottawa, to facilitate the gathering of data for the information of the Government and the National Advisory Committee. Its members were :

Colonel Biggar, (Chairman) ;
J. A. Russell (alternate R. B. Viets) Finance Department;
Brig.-General A. G. L. McNaughton, Department of National Defence;
K. M. Cameron (alternate C. R. Coutlee) Public Works Department;
J. T. Johnston, Department of the Interior;
V. W. Forneret, Department of Marine and Fisheries;
E. B. Jost, Department of Railways and Canals;
G. Wrong, Department of Trade and Commerce.

In 1926, the question of power development on the St. Lawrence River was made the subject of a conference between the State Water Power Commission of New York and the Ontario Hydro-Electric Power Commission. These bodies met in Toronto on July 7 to 9, and the delegates were:

Ontario Hydro-Electric Power Commission

Hon. G. Howard Ferguson, Premier;
C. A. Magrath, (Chairman) ;
Hon. J. R. Cooke;
C. A. Maguire;
F. A. Gaby, Chief Engineer;

J. H. Hogg, Hydraulic Engineer;
Arthur V. White, Consulting Engineer.

State Water Power Commission of New York

Roy G. Finch, State Engineer, (Chairman);
Albert Ottinger, Attorney-General;
Joseph A. McGinnis, Speaker of the Assembly;
Randall Leboeuf, Jr., Deputy Attorney-General.

Following a conference on July 7, Premier Ferguson expressed satisfaction with the outcome. Both Ontario and New York, he said, recognized that they had an exceedingly valuable asset in international waters, and both were desirous of developing them to the greatest advantage of both parties. The discussion had shown that there was a determination to reach common ground on the broad principle of the development of international waters. Roy G. Finch, on behalf of the visitors, said that he felt their deliberations were bound to lead to an agreement by which development on the St. Lawrence could be carried forward for the greatest benefit of the Province of Ontario and the State of New York.

The New York delegation visited Niagara Falls on July 8, and on July 9, Roy G. Finch, and Randall Leboeuf, Jr., went into conference again with the Ontario officials. Afterwards a joint statement was issued which said in part:

> The applications and plans which have been deposited with the New York State Water Power Commission, covering both single and two-stage developments on the St. Lawrence River, were discussed in detail. It was agreed that all plans and estimates of cost covering the suggested developments presented to the State Water Power Commission of New York would be left with the Ontario Hydro-Electric Power Commission for further examination, and another conference will be held in two weeks' time.

A second conference, therefore, attended by the same repre-

sentatives,, took place in Toronto on July 28, but its findings were not made public. Mr. Finch, however, made a statement to the press in which he indicated that a full discussion had taken place, and the advantages and disadvantages of the various plans had been considered. It was a big problem, he added, and a final decision as to the type of development could not be made until full opportunity had been given for a careful study of the various plans.

On September 24, it was announced that the State Water Power Commission of New York had adopted a final plan for the development of its water power resources on the St. Lawrence River. This was for a single-stage development, and it specified that a dam should be constructed across the river near Barnhart Island. Recognizing that the rights of Ontario were substantially identical with those of the State of New York, and that co-operation was essential, it was provided that if a license were issued the licensee must make a further study in co-operation with representatives of Ontario.

The New York State Water Power Commission was favorably disposed towards the applications of two corporations, the Frontier Corporation and the American Super Power Corporation, and it was believed would have granted them the necessary permits had not Governor Alfred E. Smith of New York State, opposed the idea of giving permits to private interests. No action was taken, therefore, and when the commission presented their report to the Legislature on February 2, 1927, they blamed Governor Smith for the delay. They also expressed the fear that if New York did not act quickly Ontario would turn to the Province of Quebec in order to work out a plan to meet its power requirements.

On November 23, 1926, the report of the Joint Engineering Board had been presented at Ottawa and Washington. It justified the feasibility of creating a shipway via the St. Lawrence River to the Great Lakes, and it presented a plan whereby a maximum of open river navigation with the minimum of locks and canal navigation would be provided. Under this plan there would not be more than 25 miles of canal navigation, and not more than nine locks and eight bridges. Throughout, estimates were for a 25 foot navigation scheme, the same as the Welland Canal deepening project.

The engineers, however, differed on the question of power development. The United States section favored a single-stage development with one dam at the foot of Barnhart Island. The Canadian members of the board recommended a two-stage development, with dams at Ogden Island near Morrisburg, and at Long Sault Island, near Cornwall. The former plan, it was contended, would be the cheaper in the first instance, the estimate for the work between Lake Ontario and Montreal being $394,000,000 as against $423,600,000 for the two-stage plan, but the Canadian engineers held that power would be available so much sooner under the two-stage development that the difference in first cost would be offset. Power would be produced under the Canadian scheme within three years, and in six years under the American scheme, while it would require eight years to complete the navigation development proposals.

On December 27, the St. Lawrence Commission, the all-American body which had been appointed by President Coolidge, submitted an exhaustive report on the whole question of water transport via rivers, lakes and canals, from the north and middle-west to the seaboard. It set out the vast

extent of productive territory contributory to and dependent upon this transport; its economic importance; the reduced cost of carriage; the possibilities of large state power developments for industrial purposes over and above the requirements of transport operations; it compared the cost and distances of the competing routes, both in construction and maintenance, and drew the following conclusions:

(1) The construction of the shipway from the Great Lakes to the sea is imperative both for the relief and for the future development of a vast area in the interior of the continent;

(2) The shipway should be constructed on the St. Lawrence route, provided suitable agreement could be made for its joint undertaking with the Dominion of Canada;

(3) The development of the power resources of the St. Lawrence should be undertaken by appropriate agencies;

(4) Negotiations should be entered into with Canada in an endeavor to arrive at an agreement upon all these subjects, and in such negotiations the United States should recognise the proper relations of New York to power development in the international section.

The reports of the engineers were detailed and exhaustive, and they dealt with the construction, cost, regulation of flow and levels of lake navigation, and the compensating works necessary on three routes.

(1) Great Lakes via the Welland Canal and Oswego to Hudson River;

(2) The same route with an additional canal cut round Niagara Falls on United States territory—an all-American route;

(3) Great Lakes to Montreal via the Welland Canal and the St. Lawrence River.

The estimated cost of these three routes was (1) $506,000,000; (2) $631,000,000; and (3) $198,000,000. The depth to be provided was 30 feet in the permanent structures, and 25 feet draft in the canals. As to operation, it was estimated that the cost of haulage would be on (1) $1.64 per ton of estimated freight; (2) $2.06 per ton; (3) 43 cents

per ton. The last route, besides being the cheapest, also afforded the advantage of a minimum of retarded navigation, and of less lockage and fewer bridges; while the distance between lake ports and northern European ports was less by 625 miles than by the Ontario and Hudson-New York route.

The time required for the construction of the St. Lawrence route was from seven to eight years, and the cost was estimated at $198,000,000, exclusive of water power installation. It was proposed that the cost should be borne by Canada and the United States in proportions to be agreed upon, and that Canada should receive repayment in consideration of the work already done in the canalization of the route between the Great Lakes and the St. Lawrence River. It was estimated that the water power developed in the construction of the St. Lawrence would reach a maximum of from 2,000,000 to 2,250,000 h.p.

The report of the St. Lawrence Commission was made public on January 3, 1927, and it was immediately pointed out at Ottawa that the organization in Canada corresponding to this commission, the National Advisory Committee, had not yet considered the report of the Joint Engineering Board and as yet a meeting had not been called.

There followed on January 29, the publication as a state paper by the United States Department of Commerce of a report made by the Transportation Division of the Bureau of Commerce on the St. Lawrence Waterway project. No less a saving than from 36.4 per cent. to 54.5 per cent. of the present lowest combination of rates was predicted for grain haulage from Duluth to Liverpool through an improved St. Lawrence with a minimum depth of 27 feet. This report, it

will be noticed, recommended 27 feet instead of 25 feet as suggested by the Joint Engineering Board. Given this standard, there was estimated a possible saving of from 5.8 cents to 9 cents a bushel on grain shipped to Liverpool, as compared with a present rate of 17 cents.

During 1927, and the early months of 1928, the St. Lawrence Waterway project entered upon a more advanced phase. From being a matter of expert investigation and study of physical and economic conditions, it became a subject of official negotiations between the Governments of Canada and the United States. The reports of the various commissions to which the project had been referred were favorable, in general terms, to further action; and the Hon. Herbert C. Hoover, chairman of the all-American St. Lawrence Commission, on the strength of the report of the Joint Engineering Board, recommended the Washington authorities to enter into negotiations with Canada in an endeavor to arrive at an agreement on the subject.

Such was the position when the Government of the United States, through the Secretary of State, the Hon. Frank B. Kellogg, made approaches to the Canadian Government on April 13, 1927. In a note addressed to the Hon. Vincent Massey, Canadian Minister at Washington, after recounting the preliminary steps that had been taken, Mr. Kellogg made the following statement:

> The Government of the United States adopts the recommendations of the St. Lawrence Commission. It appreciates the advantages which will accrue equally to both countries by the opening of the waterway to ocean shipping. It feels that the necessary increase in railway rates due to the war, and the modern practices respecting the generation and transmission of hydro-electric power, have increased the importance and practicability of early development, and believes that the fac-

tors which influence its conclusions must have equal application to, and influence upon, the Dominion of Canada.

Mr. Kellogg concluded the note with the following observations:

> In view of the action already taken by both governments, it is apprehended that they are in accord on the principle that the project should be undertaken. If this Government's conclusion in this respect be correct, there only remains to be effected an understanding as to the methods and means for its earliest accomplishment. It seems highly appropriate that the development of the common highway for the benefit of both countries should be jointly undertaken. This Government is prepared to enter into negotiations with a view to the formulation of a convention appropriate to this subject and should be grateful to be informed of the views entertained on this subject by your Government.

In his reply of July 12, 1927, Premier Mackenzie King stated that the Canadian Government shared the appreciation felt by the Government of the United States in the important problem of the development of the St. Lawrence River. He pointed out that while the report of the Joint Engineering Board was unanimous in many respects, it indicated differences of opinion on important phases of the development proposed. It was understood that in the appendices to the report, then in preparation, alternative schemes would be presented which would be of essential value in arriving at a conclusion. It was also pointed out that the National Advisory Committee appointed by the Government of Canada to report on the project would not be in a position to do so until all the findings of the Joint Engineering Board were available. The Premier concluded:

> Upon receipt of the report of the National Advisory Committee and upon consideration of the other factors involved, the Government of Canada will be able to determine its policy on the question, and will have pleasure in discussing further with the Government of the United

States at as early a date as possible the whole situation, including the proposals contained in the present note of the Secretary of State. (1)

The publication of the official correspondence brought comments from *The Montreal Daily Star* of July 18, favorable to an arrangement for power development in the St. Lawrence, but affirming that, so far as the waterway was concerned, it would be the highest folly to proceed with the project just then. Another Montreal newspaper, *The Gazette*, took exception on the same day to the apparent assumption on the part of Mr. Kellogg that the Canadian Government had accepted the principle of joint development, and it called upon Premier Mackenzie King to formulate a policy that would protect Canadian rights in the St. Lawrence River. It added that "such a policy would mean rejection of the principle of internationalization."

The *Manitoba Free Press,* in its issue of July 19, stated that:

> As the time approaches for a decision upon the question, Montreal and the Quebec Government will do well to reconsider the wisdom of continuing an attitude of unquestioning hostility to this project. Powerful as they are politically, they might find that they had considerably over-estimated their influence were they to attempt to block an enterprise behind which—assuming that a fair and reasonable agreement should be reached by the two countries—a very great body of favorable public opinion could be readily rallied.

In reply, *The Gazette,* on July 20, pointed out that Montreal's attitude was not governed by selfish considerations. This newspaper said:

> Montreal's motive has no relation whatever to tons of merchandise, to bushels of wheat, or to dollars and cents; it rests upon something different, something bigger and something higher—the preservation of Canadian rights in Canadian natural resources.

(1) *St. Lawrence Waterway Project. Correspondence between the Governments of Canada and the United States, 1927-28,* p. 6, 7.

On July 30, 1927, it was announced from Ottawa that the Joint Engineering Board had completed the work of assembling the appendices of their report, and had submitted these to the National Advisory Committee of Canada, as well as to the American body, the St. Lawrence Commission. The completed report proposed a third plan for power development.

It will be remembered that in the first report, the Canadian engineers had recommended a two-stage, and the American engineers a single-stage development. The alternative plan held to a two-stage development, but with the upper dam located at Crysler Island below Morrisburg instead of Ogden Island above Morrisburg. The change involved an additional expenditure of $4,000,000, but the engineers considered that it promised better financial returns. In the opinion of *The Globe,* Toronto, of August 1, this proposal appeared to have been the means of avoiding a possible deadlock between Canada and the United States over an important initial phase of the St. Lawrence development.

The attitude of the United States was discussed by the Hon. William Phillips, American Minister to Canada, in an address to the Canadian Club of Toronto on October 13. He said:

> We have asked our friend and neighbor of the north to consider joining with us in the discussion of ways and means to the end that this waterway may be realized in this generation. (He stated definitely that any suggestion of United States control of Canadian territory would be as repugnant to the United States as it would be to Canada). With patience and mutual confidence all difficulties can be overcome, and we who have common interests in all these problems will surely find their solution.

At the meeting of the Ontario Associated Boards of Trade and Chambers of Commerce, held at Kitchener on

A section of the water front at Toronto

Courtesy Toronto Harbor Commission

November 10, the St. Lawrence Waterway project received considerable attention. A resolution moved by Colonel W. F. Cockshutt of Brantford, on behalf of the Toronto Board of Trade, proposed that the Dominion Government be urged to proceed without unnecessary delay to make appropriate arrangements for the early construction of an enlarged St. Lawrence Waterway; also for the development of hydro-electric power from the St. Lawrence River between Montreal and Lake Ontario.

The St. Lawrence development was discussed at the eighteenth annual convention of the New York State Waterways Association, held in New York on November 11 and 12. The following resolution was adopted:

> We reiterate our original position in opposition to spending United States money for the construction of a ship canal in the St. Lawrence River, on the grounds that the canal is economically impracticable, and its construction would be an unwarranted waste of public funds.

The Great Lakes Harbors Association of Canada and the United States met in Toronto in November, when the president, William G. Bruce of Milwaukee, stated that sectional interests confined to small areas in the east were obstructing a realization of the deep waterways project. He alleged that New York City "is seeking to deprive the mid-west of its God-given right of access to the Atlantic Ocean, and the further right to convert its lake harbors into ocean ports." Governor W. L. Harding, of Iowa, explained that the new development was only a matter of continuing a policy that was as old as both nations—that of the joint and free use of the St. Lawrence for navigation. He added: "What we want is transportation relief. We want it under terms which would leave our two nations occupying the same relative positions as to control and possession that they now occupy."

The suggestion that the United States might be induced to pay the entire cost of the proposed improvements was advanced in a series of seven articles which appeared in *The Toronto Daily Star,* on December 17, 19, 20, 21, 22, 23 and 24, 1927. These affirmed the great advantages to Canada of the proposed development, and stated that:

> The Dominion would not have to part with any degree of control over her own territory in order to obtain the deep waterway. The United States is not asking for part title in or part control over the new Welland Canal or the all-Canadian section of the St. Lawrence. Hon. Herbert Hoover, U.S. secretary of commerce, has stated most explicitly that his government does not desire anything of the kind. A joint commission to superintend construction on the international section and to co-ordinate construction on the Canadian section and a joint board to regulate the flow of water in the international section represent the extent of proposed international intervention. Without the latter, power interests might take so much water that the interests of navigation at Montreal would be prejudiced. As the two countries have to share in the cost of the work on the international section, both must have a place in the construction organization.

The Star compared the expenditures of Canada and the United States regarding the improvement of international channels of the upper lakes with expenditures which Canada has assumed in order to develop the Canadian route, and added:

> Altogether it seems to be time that the United States paid her share of the bill for works of mutual benefit to the two countries and this she is willing to do. Our big neighbor might even be persuaded to stand the entire cost of new St. Lawrence navigation improvements, 167 millions, in return for the expenditure of 145 millions by this country on other navigation improvements. A fair return for Canada's expenditures on the new Welland canal cannot be obtained if the big ships thus enabled to get down from the upper lakes find themselves bottled up in Lake Ontario. (1)

(1) *The Toronto Daily Star,* December 24, 1927.

HISTORY OF THE NEGOTIATIONS OF THE ST. LAWRENCE WATERWAY PROJECT, 1832-1929 (1)

Fourth Period, January 1928 to March 1929

On January 19, 1928, the Ontario Municipal Electrical Association, representing five hundred municipalities in Ontario, at its meeting in Toronto adopted a resolution urging the Dominion Government "to proceed, without unnecessary delay, to make proper arrangements for the early development of electrical power from the St. Lawrence River in Ontario." The resolution concluded with the recommendation, "That such development be under the administration and control of the Government of Ontario, on behalf of the municipalities of this Province."

Opposition to the deepening of the St. Lawrence between Montreal and Kingston was shown by the Canadian Navigators' Federation at its annual meeting held at Toronto on January 20, 1928. The resolution adopted unanimously by the organization stated that:

> The Canadian Navigators' Federation, Inc., here assembled in annual convention, do oppose the deepening of the St. Lawrence River between Kingston and Montreal, as it would destroy the Canadian shipping and be detrimental to the best interests of our profession. Montreal should be the logical ocean port and Kingston the terminal for the big upper lakes vessels.

The attitude of the Canadian Government towards the development of the St. Lawrence River was explained by

(1) *The Canadian Annual Review of Public Affairs*, 1919, and subsequent volumes.

Premier Mackenzie King in Parliament on April 11, 1928, a few days before the report of the National Advisory Committee, and the correspondence with the United States Government, were submitted to Parliament. He stated that in the negotiations no commitments had been made of a character that would in any way prove prejudicial to the Dominion or to any province. The Government regarded the St. Lawrence development as one of the largest projects the country has ever faced, and felt that it should proceed with the negotiations with the utmost caution; not with undue haste nor with undue delay. He concluded: "If the project, as I believe it to be, is one that will come in the course of time, and which has very much, even now, to commend it, if certain economic considerations can be satisfactorily met, then it will be made all the more certain of accomplishment by being advanced cautiously step by step, but always in the right direction."

During January, 1928, the National Advisory Committee met at Ottawa to consider the report of the Joint Engineering Board in its completed form, and to draw up its own report to the Canadian Government. This report, bearing date of January 11, 1928, was tabled in the House of Commons on April 17. The committee presented majority and minority reports. In the majority report the committee concurred in the finding of the Joint Engineering Board that the project was feasible, but it proposed that the channel should have a depth of 27 feet.

As to the desirability of the construction of the waterway at the present time, the committee confirmed the opinion of the International Joint Commission that the benefits to be derived from the opening of a water route to the sea would at first accrue in larger measure to American than to Canadian

interests, though it was reasonable to assume that eventually the advantages might be more evenly distributed. The Advisory Committee expressed the view that the initial development should take place in the purely domestic section of the river lying within the Province of Quebec.

> We believe, they said, that if a reasonable time were permitted in which to enable the resultant power to be economically absorbed the development of this national section would be undertaken by private agencies able and willing to finance the entire work, including the necessary canalization, in return for the right to develop the power.

Concerning the international section the committee called attention to differences between the engineers and suggested further discussion of the engineering problem in which Ontario should be represented. On the financial aspects the committee stated that, owing to Canada's heavy financial commitments as a result of the war, they would recommend that no action be taken at present if Canada proposed to assume responsibility for half the new financial obligations involved. They analyzed the financial problem as divided between the United States and Canada, as affected by both existing and projected works, tabulating their conclusions as follows:

CANADA

Present Works:		
St. Lawrence ship channel	$ 30,000,000	
St. Lawrence and Welland Canals	50,000,000	
Lock at Sault Ste. Marie, Ont.	5,560,000	
		$ 85,560,000
Proposed Works:		
Welland Ship Canal	$115,600,000	
National section, St. Lawrence shipway, 27 foot navigation and development of 949,300 h.p.	199,670,000	
		315,270,000
Total for Canada		$400,830,000

UNITED STATES

Present Works:		
Dredging St. Clair and Detroit Rivers	$ 17,536,000	
Locks at Sault Ste. Marie, Mich.	26,300,000	
		$ 43,836,000
Proposed Works:		
International section St. Lawrence shipway, 27 foot navigation and initial development of 597 h.p.	$182,157,000	
To complete development—additional power 1,602,000 h.p.	92,090,000	
Upper lake channels to 27 feet	65,100,000	
		339,347,000
Total for United States		$383,183,000

As a result of this statement of the case the committee advised that "it would not be unreasonable to expect the United States to undertake the entire work, both for navigation and power, in the international section," and they added that even if that course were followed the preponderence of outlay would still be with Canada. They recommended further that, in addition to the construction of the international section, the United States should undertake the deepening of the channels from Lake Erie to Lake Superior to a depth of 27 feet. They recommended that the Welland Canal should retain its purely Canadian character. The control of the works during construction, the committee advised, should be under the technical supervision of an international commission, which body might also be charged with full authority on completion, to direct maintenance and operation and to regulate the use of water at the power plants in the international section in order that such use might be prevented from creating conditions harmful to navigation in any part of the St. Lawrence.

The committee stated that it was opposed to the export of power and expressed the view that in the national interests such arrangements should be made as would enable the Province of Ontario to secure her power requirements for eastern territory from the purely Canadian section of the river pending the development of the international reaches. Regarding the negotiation of a treaty between the two countries, the committee expressed the opinion "that in the event of a new treaty being negotiated the United States should not be given any greater rights than obtain in existing treaties."

Upon receipt and consideration of the report of the National Advisory Committee, the Canadian Government resumed discussion of the subject with the Government of the United States. On January 31, 1928, the Hon. Vincent Massey advised the Washington authorities of the conclusions of the Advisory Committee, in which the Canadian Government concurred. The Canadian note opened with a discussion of some opinions expressed by the United States Secretary of State as to the advantages of the waterway being equally important to both the United States and to Canada. On this subject the Canadian Minister pointed out that Canada had already expended large sums on the improvement of transportation both by water and by rail, and that railway rates in Canada "are in general lower than in the United States." He continued:

> It will therefore be observed that the transportation situation in the two countries is not identical as to available facilities, extent of use, or rates and that the economic handicaps to which you referred in your note of April 13 appear to have more application to United States than to Canadian conditions. In this connection, it may be said that Canadian agriculture is more directly affected by the restrictions on the importation of Canadian farm products which have been imposed by the United States in recent years, with the object, it is

understood, of assisting agriculture in those Western States which would share so largely in the benefits of the proposed St. Lawrence Waterway. This situation, and the effects upon the Maritime sections of Canada of United States duties on the products of the fisheries, are among the factors which have contributed to bringing it about that public opinion in Canada has not so clearly crystallized in favor of the waterway project as appears to be the case in the United States.

The Canadian note went on to call attention to the fact that public opinion in Canada was opposed to the export of hydro-electric power and it put forward the proposal that in any arrangement for the waterway "the development of power on the Canadian side should not exceed the capacity of the Canadian market to absorb it." Attention was directed to differences of opinion within the Joint Engineering Board, and assurance was asked that the flow of water from Lake Ontario should be controlled so as to protect the interest of the purely national sections of the river and the port of Montreal. In this connection, the view was expressed that it was desirable that the engineers representing the Province of Ontario should be consulted.

In regard to finance, the Canadian Minister presented the view put forward by the majority of the National Advisory Committee, and he proposed that

> The construction of the wholly Canadian (Welland and St. Lawrence) sections, and, if the United States should see fit, of the upper lakes works, would, on this plan, be given precedence of the international section, because of the necessity alike of providing for further consideration of the engineering problems involved in the international section and of permitting reasonable absorption of the power developed on the Canadian side.

In conclusion, he informed the United States Government that there were differences of opinion between the Dominion and the provinces in regard to jurisdiction, differences which

had been referred to the courts for settlement, and he expressed the hope that, in the discussion of the waterway, an opportunity might be found "for reaching a comprehensive settlement of all outstanding problems affecting the Great Lakes and the St. Lawrence, including the preservation of the waters properly belonging to the St. Lawrence watershed."

Replying on March 12, the United States Secretary of State said that the United States Government

> is inclined to regard as an acceptable basis of negotiation a proposal along the general lines suggested in your note; that the prosecution of the improvement of the St. Lawrence waterway be based on the undertaking by the United States of the deepening of the necessary channels through the interconnecting waters of the Great Lakes and the improvement of the international section of the St. Lawrence both for navigation and for power; and the undertaking by Canada of the construction of the waterway in the sections wholly Canadian, that is, the Welland Canal and the works in the St. Lawrence below the international boundary.

He took exception to the proposal to delay the construction of the works in the international section and urged that:

> the works ought to proceed so that all parts of the navigation system would be completed substantially at the same time and the United States ought to have the advantage of its share of the power of the international section without waiting until Canada may be able to sell her power from these works.

He also took exception to the manner in which the Canadian balance sheet was made up, objecting specifically to the inclusion of the cost of the St. Lawrence and the old Welland Canals, except so far as they might be of use to the deeper system, and he further suggested that the costs of navigation and of power should be segregated. He agreed with the opinion expressed in the Canadian note that the depth of the channel should be 27 feet. The note continued:

> The United States fully recognizes the right of the Dominion of Canada to the ownership and use of the Canadian share of the power which may be developed in the international section of the waterway as well as to all that may be developed in the national section and it recognizes also that the disposition of the power is purely a domestic question. It recognizes further that this share is an inherent attribute of Canadian sovereignty, irrespective of the agency by which the power may be developed.

He accepted without reservation the principle that the operation of works in the international section shall be such as will control fluctuations of the outflow from Lake Ontario in a manner which will safeguard all interests on the purely Canadian sections of the river, including especially the port of Montreal. He suggested that when the economic and financial problems had been solved, the solution of the engineering problems would be speedily realized, and he closed by accepting the Canadian proposal to include in the negotiations "any outstanding problems affecting the Great Lakes and the St. Lawrence."

On April 5, 1928, Laurent Beaudry, replying for the Canadian Minister, commented upon Mr. Kellogg's protest against delay in the construction of the international section by again emphasizing as an essential factor the provision of some method for assuring that the development of power to be utilized in Canada should not outrun the capacity of the Canadian market. He further called attention to the necessity of reconciling the difference of opinion among the engineers as a preliminary to any computation of costs, and he informed the United States Government that the Canadian Government was proceeding to consult the Governments of Ontario and Quebec, and that following such consultation, the Canadian Government would be in a position to communicate further with the United States.

The correspondence terminated with a letter from the United States Secretary of State dated April 7, in which the Canadian proposal that the engineering difficulties should first be taken up was accepted. Mr. Kellogg said:

> The United States section of the Joint Board will be prepared at any time to take up with the full Board and discuss and reconsider engineering problems connected with the construction of the International Section. I have the honor to suggest, however, that it would seem as though the entire subject of treaty negotiation need not be postponed until the termination of these discussions and of the reconsideration by the Joint Board of Engineers and that it might be desirable for the negotiations to go on concurrently with the examination of such engineers as their advice and assistance would be necessary.

The publication of the report and the correspondence brought forth comment from various quarters. On April 18, the Prime Minister of Ontario, the Hon. G. H. Ferguson, was quoted in the newspapers as having made the following statement:

> The report seems to indicate that the negotiations have been carried on in the assumption that the Canadian people are prepared to sell a proprietary interest in the biggest national asset we have for a few dollars of American money. I do not agree with that. The biggest asset we have is the St. Lawrence River and we should retain complete sovereignty of navigation to the sea. There is no doubt in the world that this is the view of the Canadian people. Besides, we have unhappy recollections of former international relationships with our neighbors to the south. I prefer to give them a privilege to use our front yard and gate as neighbors rather than give them a right as joint owners. This is all that I can say until I give the matter further consideration.

The Prime Minister of Quebec, the Hon. L. A. Taschereau, took occasion when speaking at Montreal on April 28 to again state his position. He said:

> We have the St. Lawrence River and that river must remain Canadian. The St. Lawrence is big enough for Canada, and Canada is big enough to take care of the St. Lawrence... Montreal is at the head of

> navigation and must remain at the head.... I do not believe in joint ventures, and I do not believe the United States should be permitted to have any control of our great waterways. I am not anti-American. I admire the Americans, their pluck, their go-ahead-ness, but I believe in Canada. I believe in our future and in the great natural resources that have been given to us. So long as I head the Government of the Province of Quebec I shall maintain that view. I believe we have got to develop ourselves the natural resources that God has given us.

The theory that the deepening of the St. Lawrence route would be injurious to the interests of Montreal as a port was discussed in the Senate on February 2 by Senator McDougald whose remarks were regarded as important, inasmuch as he was at the time chairman of the Montreal Harbor Commission as well as a member of the National Advisory Committee. Senator McDougald gave it as his considered opinion, and the opinion of the technical staff of the Harbor Commission, "that the business of the port will increase rather than decrease on the completion of the deepening of the waterways, which would give an impetus likely to double the present volume of business at the port of Montreal."

Public attention was directed to the proposal of the National Advisory Committee that the initial development should take place within the Province of Quebec, and that if a reasonable time were permitted to enable the resultant power to be economically absorbed, the development of this national section would be undertaken by private agencies able and willing to finance the entire work, including the necessary canalization, in return for the right to develop the power.

Parliamentary debates on the St. Lawrence development took place both in the Senate and in the House of Commons during the session of 1928. In the debate on the Address in the Senate, the Hon. George P. Graham

advised the Government to obtain the advice of the leading shippers upon the economic prospects of the navigation side of the proposal. The Hon. N. A. Belcourt cited Canada's experience with the United States over the Chicago Drainage Canal as a warning. The Hon. F. L. Beique, on May 21, urged that the cost of the work should be divided between power and navigation; that the power cost should be divided between Ontario and Quebec, and that the navigation cost should be shared between Canada and the United States in proportion to the traffic of the two countries through the canals. This, he claimed, would result in four-fifths of the cost being borne by the United States, an arrangement, he believed, in which that country would be quite willing to concur.

The Hon. G. Lynch-Staunton asked whether the waterway would be worth what it cost. He warned the Government against giving control of the Canadian channels to the United States, and he put forward the view that under the United States Constitution the Federal Government of that country had no ownership of the American side of the waterway. The Hon. J. P. B. Casgrain called attention to evidence that the levels of the lakes had already been lowered and he expressed the view that rather than deepen the channel from Prescott to Montreal, it would be cheaper to carry the grain by rail.

Later in the session, Senator Casgrain asked for information regarding the use of Canadian canals by foreign vessels other than those of the United States, and in this debate the Hon. J. D. Reid suggested that tolls should be charged such vessels for the use of Canadian canals. The Hon. C. E. Tanner, on April 20, moved for the appointment of a spe-

cial committee on the St. Lawrence development. This committee heard a number of witnesses and reported on June 7 recommending that the enquiry should be continued at the next session. This report was adopted by the Senate the same day.

The Montreal Chamber of Commerce, by resolution adopted on May 9, disapproved of the deepening of the St. Lawrence canals by the Federal Government, and opposed the principle of the development of the Canadian section by private enterprise.

During the latter part of 1927, the question of the ownership of the water powers of the St. Lawrence River had presented itself, and given rise to some discussion. It was felt that a judicial decision should be obtained as to whether the power rights in the river were the property of the Dominion or of the provinces concerned. The question, therefore, was brought before the Dominion-Provincial Conference at Ottawa on November 10 by the Hon. G. Howard Ferguson, Prime Minister of Ontario, who pointed out that if it were agreed that the question should be submitted to the courts for adjudication, it would be well for the Minister of Justice and those interested to confer and agree upon the terms of submission.

The Hon. Ernest Lapointe, Minister of Justice, said that inasmuch as the matter affected all the people of Canada, it would be impossible for the Government to decide what course it should take until it had discussed the matter in the Cabinet. The Hon. Charles Dunning, Minister of Railways, pointed out that any dispute or difference of opinion on the power question related to waters on which the Dominion had spent vast sums in canalizing, thereby creating a head of

water. There had been no difference of opinion in respect to water not canalized, and in connection with which plans for power development must go to the Public Works Department for approval. Premier Ferguson replied that it would be well to have the whole question of jurisdiction cleared up.

By an Order in Council dated January 18, 1928, the Federal Government referred to the Supreme Court of Canada a series of questions for the purpose of deciding the respective rights of the Dominion and the provinces concerned in water powers. Subsequently, after discussion with the Governments of Ontario and Quebec, the questions were revised and added to, and were finally approved by Order in Council dated April 14.

Rather more than a year elapsed and it was not until February, 1929, that the judgment of the Supreme Court was delivered. The questions contained in the Order in Council and the replies of the Court are set out in detail in Appendix III.

During the latter part of 1928 and the early months of 1929, the St. Lawrence Waterway project became a subject of increasing interest. There was much public discussion on the opinions that were being freely circulated, and the newspapers were devoting a more than usual amount of space to the speeches of prominent men, and to editorial observation.

At the close of 1928, the Hon. Herbert C. Hoover, in connection with his Presidential campaign in November, advocated the *necessity* of the St. Lawrence Waterway in a speech at St. Louis. He pointed out that:

> The shifting of economic currents demanded a new vision of interior waterway development. There was opportunity, he explained, to create three great trunk lines of water transportation—one north and south, 1,500 miles from New Orleans through St. Louis to Chi-

cago, and thus by the lakes to the northern boundaries of the United States; another east and west, 1,600 miles, from Pittsburgh through St. Louis to Kansas City; the third, a shipway through the St. Lawrence connecting Duluth and all the lake ports with the sea. When completed, including the St. Lawrence waterway, the entire system would comprise 12,000 miles of most essential transportation, connecting twenty states with the Gulf of Mexico on the one hand, and with the Atlantic on the other. *The Montreal Daily Star,* November 7.

Senator W. L. McDougald, addressing the Canadian Club in Toronto, emphasized the fact that for years the Canadian people have been developing the waterway, and that the completion of an improved channel, enabling vessels of 27 foot draft to navigate from the head of Lake Superior to tidewater, "was an ideal that should be pursued to its attainment." He proceeded:

We have seen something of the history of the St. Lawrence Waterway. We have seen the situation as it exists to-day, or will exist with the completion of the Welland Canal. We have looked at the proposed plan, and I think we are agreed that it is feasible, practical, necessary and urgent. We have considered the general and incalculable benefits to be derived from the waterway in navigation and power, and I think we must agree that they are possible, and that the whole waterway project is a consummation devoutly to be wished.

It is inconceivable that the rapidly expanding industrial and commercial needs of the St. Lawrence basin will permit 5,000,000 h.p. of electrical energy to remain much longer undeveloped, the full potentialities of one of the world's greatest waterways.

But, I do not think Toronto will became an ocean port in the same sense as Montreal, where steamers can figure on an unbroken passage from the sea, and must run on schedule with assured cargoes.

While he did not agree with the idea that ocean liners will go above Montreal, Senator McDougald said that a tramp, or vessel not tied to any definite route and operating independently, will traverse the inland route. He added:

And, if Montreal still remains the premier port of Canada, as I am firmly and frankly convinced it will, there is no doubt that Toronto will share in Montreal's reflected prosperity, just as the rest of the

country will share in it. Ocean boats will discharge their cargoes to lake boats at that point, and with the way to the lakes open for larger boats, and a reduction in time through reduced lockages, trade and commerce in and out of Toronto is bound to be speeded up.

Unquestionably, also, Toronto will benefit tremendously through the development and distribution of the power which the waterway will provide in the international and national sections. *The Gazette,* Montreal, November 20.

Senator G. Lynch-Staunton stated at an Empire Club luncheon at Toronto on November 29:

The engineers have told us that the development is possible and feasible, but that means nothing because anything is possible. It is now admitted that the *Mauretania* will never strain at her anchor in the harbor of Fort William, nor even in Toronto harbor. Everyone admits the deepening will be good for Montreal, but would it be good for Canada?

He went on to say that transportation by canal is not a modern method, and that if the waterway scheme eventually comes about, shippers will use the canals but little. He added:

In any event, it would take business from our railways, which have cost us so much, and we are giving the Canadian National Railways from $75,000,000 to $100,000,000 a year to keep going. We shall save 2 cents a bushel on Canadian wheat, but the development will be made for the benefit of American traffic, which would use the canals more than we should. The United States exports just as much grain. Canada is not the granary of the world any more than Russia or the United States.

General prosperity and faith in future developments, was the keynote of an address by Mr. Peleg Howland, president of the Imperial Bank of Canada, at the annual meeting of shareholders held in Toronto on November 28. Concerning the St. Lawrence Waterway project, he said:

It would seem desirable, since we have gone to enormous expense to enlarge the Welland Canal, that negotiations should begin as early as possible with the United States to bring about the completion of

the outlet through the St. Lawrence. Surely, differences between the Dominion and the two provinces as to the ownership of river beds, and between Ontario and Quebec as to the mode of development of power, can be settled in the common interest of all.

While it may not be that all the benefits claimed will accrue from the development, the movement of grain from the west will be at least hastened, and the capacity to cope with an ever-increasing flow will be enlarged. If, as stated, the enormous development of electrical power can be made to pay the total cost to this country, one would think that the work should be done with the least possible delay. *The Gazette,* Montreal, November 29.

An opinion from the prairie provinces was voiced by *The Saskatoon Star-Phoenix* early in January, 1929. This journal said:

The west has now a Pacific route by way of Vancouver for its exportable surplus, and will shortly have a third outlet in Hudson Bay. Therefore, the hope of the St. Lawrence development does not stir the west as it does Ontario. Yet one would not say that there is indifference toward the subject in these provinces. Having no prejudices against working with the United States, they regard the building of a deep waterway co-operatively as inevitable at some future date. That is a fairly accurate statement of western opinion at this stage.

Before relinquishing office in January, the executive officers of the Montreal Board of Trade felt that an announcement should be made with regard to their study of the proposed Great Lakes and St. Lawrence Waterway project, and a statement was unanimously adopted and ordered to be published in the forthcoming annual report. In this statement it was set forth that as their study of the scheme had progressed it had become increasingly apparent that the project constituted one of the most important issues that had confronted the people of Canada, but that it was a problem that could not properly be considered or comprehended from any single aspect, as many of its co-related phases demand exhaustive inquiry and

extended investigation before a justified opinion could be reached. The statement added:

> Time will doubtless do much to clarify the situation further, and your council feels that its successors in office should be enabled to continue the study untrammelled by previous and perhaps immature opinions. *The Gazette,* Montreal, January 18.

The Citizen, Ottawa, on January 18, pointed out that:

> Development of hydro-electric power on the St. Lawrence River should take second place to navigation, according to Charles A. Magrath, chairman of the Canadian section of the International Joint Commission, and chairman of the Hydro-Electric Power Commission of Ontario.
>
> Mr. Magrath's opinion was by way of an observation on the prediction made by Professor Duncan McArthur, of Queen's University, in a speech made before the Ottawa branch of the Engineering Institute of Canada, that navigation on the St. Lawrence may eventually be subordinate to hydro-power projects coincident to the big scheme.
>
> We have no desire, and I am sure I speak for the whole commission, to subordinate navigation to hydro-development on the St. Lawrence, Mr. Magrath said in effect. As to whether the proposed Beauharnois development would prejudice the ultimate waterway scheme I am not prepared to give my opinion at the moment. Ontario will not get any power from that development, though we hope that in the complete development we will get our full share.

Bernard K. Sandwell, former Professor of Economics at McGill University, speaking before the Canadian Club at Toronto on January 28 said he was uncertain

> as to whether it was possible to organize a joint international waterway project for the development of the St. Lawrence as a through international waterway without granting to the United States additional rights to those which she now possessed.

Mr. Sandwell emphasized the point that any right that Canada might grant would be one of enormous importance and value, and that she should make sure she is getting value in return. He went on:

> We have to make sure that anything the United States undertakes to give is something and she can deliver without our having to go into the United States Supreme Court and sue for it.

He added that he was neither an advocate nor an opponent of the scheme. The existing rights of Canada and the United States in that portion of the St. Lawrence Waterway that lies wholly within the Dominion of Canada was the key to the whole proposition, and that there had been very little discussion of these rights. *The Montreal Daily Star,* January 29.

At the end of January, 1929, a circumstantial story of the plans already made, or in process of being made, for the use of Canadian power from the St. Lawrence, began to emanate from New York. The success achieved in dealing with the power question at Niagara, evidently confirmed the American belief that Canada would enter into a treaty for the development of the St. Lawrence River under international supervision, and that the power which Canada would be unable to market at home would be exported to the United States. *The Montreal Daily Star* said in an editorial on January 29, 1929:

> There is nothing extraordinary in the statement that as soon as Mr. Hoover assumes office as President, the St. Lawrence Waterway question will be taken up and a committee will be appointed to negotiate a treaty. Mr. Hoover has been and is a whole-hearted and zealous advocate of the project, which was one of the planks in his Presidential campaign platform. There is no doubt whatever as to Mr. Hoover's position. Much less is known of the Canadian Government's position. Acceptance by Canada of the principle of international development and control is the first consideration from the United States point of view.
>
> There can be little doubt that New York interests regard the whole question as settled for all practical purposes, and that formal acceptance by the King Government is, to them, a foregone conclusion.

At the end of January, George Henderson, retiring president of the Montreal Board of Trade, speaking at the annual

general meeting said that, in his opinion, no harm could come to Canada by delaying the decision on the St. Lawrence Waterway scheme "until such time as the people have had an opportunity intelligently to understand the project and to give their views upon it." *The Gazette, Montreal,* January 30, 1929.

Early in February, the eagerly awaited decision of the Supreme Court of Canada in regard to the series of questions which had been addressed to it by Order in Council, dated January 18, 1928, was announced. These questions together with their answers are set out in detail in Appendix III.

In summing up the judgment, *The Gazette,* Montreal, on February 6, stated in a leading article:

> The finding of the Supreme Court in the reference to determine the respective rights of the Dominion and the provinces in regard to water power development on navigable rivers is more important in its practical bearings than it appears to be as a judicial pronouncement. From the latter point of view it is inconclusive, so much so as to leave the question in issue pretty much where it was before the reference was made. The Court's judgment, so far as it goes, is unanimous, but there seems to have been so much ambiguity in the terms of the reference itself that a definite decision could not be reached. Some of the questions could not be answered. The Supreme Court was faced with an impossible task, at least, as regards some of the points raised in the questions submitted. The Court did find, however, that the provinces have the right of water power development in provincial rivers, subject, however, to the condition that navigation must not be interfered with. This confirmed the contention of the provinces, but left the actual question of interference undetermined. Certain other questions were answered in a manner which afforded some encouragement to the Dominion, but the judgment failed to clarify a situation which had been greatly complicated by the assertion of Federal authorities.

Further action was discussed, presumably by way of reference to the Privy Council, but the difficulty that presented itself was, that if the Government could not frame a refer-

ence upon which the Supreme Court of Canada could pass a definite judgment, how could it frame a case that would be intelligible to the Privy Council?

Speaking to a representative of *The Montreal Daily Star* on February 8, the Hon. Frank G. Kellogg stated that he did not see any reason why the failure of the Canadian Supreme Court to reach a decision on the St. Lawrence Waterway jurisdiction, should delay negotiations between Canada and the United States for the commencement of the projected deep waterway and power scheme. He intimated that he had no immediate idea of the reopening of negotiations, but he added:

> Canada knows our position. We have been trying to get a treaty for years, and I shall continue to do all I can to bring about an understanding with Canada on the subject.

In Quebec, the opinion was shared both by the Hon. L. A. Taschereau, Prime Minister and Attorney General, and Charles Lanctot, K.C., Deputy Attorney General, that the reasonings went further than the actual judgment in favor of the position of the provinces. *The Montreal Daily Star,* February 8.

The same newspaper on February 8, gave an account of a debate in the United States Senate on the preceding day in regard to the St. Lawrence Waterway. Senator Thomas J. Walsh of Montana, took occasion to controvert arguments used by Bernard K. Sandwell of Montreal in an article in *The Atlantic Monthly.* At some length the Senator for Montana argued the constitutional question involved concerning the state rights and federal powers, and said:

> It is idle to suggest that a self-respecting Government having entered into a treaty with the concurrence of the President and the Senate by a two-thirds vote, would then seek to evade its obligations

unless under the compulsory ruling of the Supreme Court. If Canada believes the Government of the United States capable of any such baseness she is wise in declining to enter into the treaty proposed, or any other treaty.

He pointed to other treaties, and also to the fact that:

Congress had—in the legitimate exercise of its undoubted authority, to preserve the navigability of inter-state streams of those open to foreign commerce—made it a penal offence on the part of any one to erect any obstruction other than docks and like structures in a navigable stream without its consent. He, therefore, claimed that Congress holds the key to the situation, and anyone proposing to erect a dam in a navigable stream for the development of power, or for any other purpose, must comply with the conditions prescribed by Congress. Whether the Federal Government may or may not construct works for the development of power, either within the river or upon land outside of but adjacent to it, it is indisputable that the State of New York cannot construct within the stream the dams necessary for the generation of power, firstly because her officers would in so doing violate the Federal statute against the erection of obstructions in navigable streams; and secondly, because she could not do so without the consent of Canada, and the Constitution forbids a state from entering into a treaty with a foreign power. It follows that, if the contention of New York be sound, the power possibilities of the St. Lawrence must be lost to the people of the United States, and insofar as the international section is concerned, perhaps to the people of Canada, because of our peculiar governmental system.

Senator Copeland stated that he had no idea that Congress would ever vote $500,000,000 for "such a gigantic piece of foolishness as the St. Lawrence canal."

Senator Walsh replied that there must be a treaty. If the provisions of the convention are permissive, then an agreement could be entered into with New York regarding power before the work proceeded. It is quite likely that, if the State of New York desires to assume so much of the total cost of the power project as it is properly allocated, in consideration of its being entitled to the electrical energy that might be

developed, Congress will readily assent to such an arrangement.

The staff correspondent of *The Gazette,* Montreal, writing in that paper on February 9, and commenting on the above debate in the Senate on the St. Lawrence Waterway project, said:

> The debate has given rise to the possibility that a new plan may be evolved in that country with which to revive interest in Canada in a treaty for the joint construction of the waterway within the near future. The United States might adopt a plan whereby the State Government, that is New York State, could assume financial responsibility for the cost of building works which were primarily for the development of water power and, incidentally, for the improvement of navigation. The State Government would thereafter have control and benefit of the electric power developed. The idea is taking form here that such an example might be followed in Canada, and the dispute which exists in both countries between Federal and Provincial Governments might be solved.

At the 26th annual meeting of the Shipping Federation of Canada, held in Montreal, on February 13, R. W. Reford, president, said:

> I can only express the hope that our country will make an exhaustive investigation of the benefits which are claimed to accrue to her from the St. Lawrence Waterway scheme, before committing itself to a project which cannot but have a vital effect on her future. *The Gazette,* Montreal, February 14.

"Any solution of Canada's problem of waterways development, would," said R. L. Calder, K.C., speaking at a meeting of the Electrical Club in Montreal on February 13, be "to develop them for navigation and for power at the same time." He added:

> The proposition confronting Canadians to-day is not one of navigation or power, but of navigation and power. Just as Europe's inland sea, the Mediterranean, was responsible for the earliest developments of that continent, so will the North American inland sea become

the centre of development in the New World. The possibilities of development are enormous on both sides. As regards navigation, there are admittedly great difficulties in the way of making a through canal from Lake Winnipeg to the sea; but Canadians are used to overcoming great difficulties. If they had been content to leave the St. Lawrence as they found it instead of dredging, Montreal would never have become an ocean port. In regard to power development, the proper administration of water power will make of Canada the workshop of the world. The idea is to make the power canals navigable. We can use it to carry our ships and to drive our dynamos at the same time. Some people say that if ocean boats can sail beyond Montreal, that city will automatically lose much of its trade, for it will no longer be an ocean terminus. This may be partly true, but if a little is lost on the navigation side, so much will be won on the power side that the compensation will be greater than the loss. As it will be an entirely new power development from Cornwall to Montreal, no ill-feeling will arise in the United States if we keep it all for ourselves. *The Gazette,* Montreal, February 14.

In his report to the Legislature at the commencement of March, Frederick Stuart Greene, Superintendent of Public Works, Albany, N.Y., urged the completion of an all-American canal by way of the port of Albany and the Hudson River, adding that unless some action was taken by the state and Federal authorities in furtherance of the project, American shipping interests would be outstripped by Canadian competitors who "are endeavoring to divert traffic to the St. Lawrence canal." He added:

At the present time Norwegian vessels of light draft are passing through the St. Lawrence canal and delivering pulp at Buffalo. A ship canal connecting the Hudson River with the Great Lakes would be a benefit not only to New York State but to the entire nation. The opinion is general that the construction of this canal will not be undertaken by the Federal Government. If the state can find some way to build the canal, in addition to the great benefit which the whole nation would derive, there is an excellent chance that such a waterway would be a paying proposition to the State of New York by 1950. *The Montreal Daily Star,* March 4.

In explaining the St. Lawrence Waterway project to the members of the Canadian Club of Montreal on March 11, Professor Leslie R. Thomson, compared it to a man intending to build an extension to his warehouse asking himself the question—Can it be done? What about the ground underneath? Is the surface sufficient to support the foundations? If he found satisfactory answers to these questions, the next question would be, Will it pay? Professor Thomson then outlined the physical features of the suggested waterway and contrasted them with the present facilities. He said that it would cost $900,000,000 if the power and navigation are developed separately, and $840,000,000 if built jointly, the joint development thus representing a saving of $60,000,000. The $840,000,000 would be chargeable as follows: $350,000,000 to navigation and $490,000,000 to power. Taking the navigation project, and assuming that one-third would be Canadian and two-thirds United States, the actual capital charge for the Canadian enterprise would be $120,000,000. He said further:

> The annual upkeep, taken on the most conservative estimate, would be $10,000,000; therefore, primary traffic savings balance cost, thus secodnary savings would be 'velvet.' The St. Lawrence Waterway will be of profound benefit to Canada. It will bring about real transportation savings, it will act as an economic regulator on the rail rates, it will stabilize and make more secure Canada's competitive export position, it will reduce the cost of imports, and will confer abundant power on the citizens of the St. Lawrence basin. The waterway project will create in the lower St. Lawrence a highly industrialized development. Finally, because it will cheapen basic east and west transportation, the waterway will make a substantial contribution to the attainment and permanent enjoyment of a goal prized by all Canadians—a national life that will be politically free because economically sound. *The Gazette,* Montreal, March 12.

On March 13 Governor Franklin D. Roosevelt of New York, assured a representative of *The Montreal Daily Star,* that he did not anticipate that navigation rights would cause any complications in his plans for power development on the St. Lawrence River by New York State.

This interview with Governor Roosevelt was corollary to a proposal made by him on the preceding day for the development of the hydro-electric resources of the St. Lawrence River by the state through a board of trustees, and distribution of power by a private corporation. This proposal the Governor placed before the New York Legislature. A proposed bill to provide for the enactment into law of the Governor's programme accompanied the message. The trustees were to receive no salary, although an appropriation of $100,000 would be provided for expenses. Governor Roosevelt said:

> If these proposals become law, we shall have the opportunity of ascertaining whether or not business and finance will accept this way of developing the state's resources for its industries, its homes and its commerce. On the one hand, is the policy of public ownership and control of our power sites, dams and power plants, with private operation of transmission lines, and distributing systems, allowing a fair return on actual capital investment? On the other side is one of two courses— either exploitation by private interests, or else public ownership and operation, not only of the site of the dam and power, but of the transmission lines and distribution systems as well. *The Gazette,* Montreal, March 13.

The Toronto Daily Star, on March 13, said:

> The growth of the port of Vancouver in the last three or four years has loosened up eastern opinion by making it clear that Montreal is not to have a monopoly as the spout of Canadian exports. Some begin to see that the St. Lawrence must be deepened and utilized to its fullest capacity; the rivalry of the Panama Canal compels this course.

A further press comment was made by *The Gazette,* Montreal, in a leading article on March 28, in the following terms:

Those who so glibly advocate the expenditure of hundreds of millions on an enlarged seaway via the Great Lakes and the St. Lawrence, for the avowed purpose of lowering transportation charges on behalf of western agricultural producers, fail to appreciate the fact that any such enterprise must bear directly upon the future earning power of the railway system, in which the Canadian people have so vast an investment. Whether or not the optimistic estimates of reduction on water carriage charges could ever be realized, even in the most favorable circumstances, is a debatable question, with expert shipping men taking the negative side of the argument; but in any event, there must arise the important question of taxation, since the cost of any such improvement would fall upon the public as a whole, and not upon the shipper as such. If the waterway advocates are right in their calculations, which is disputed, land transportation is bound to be adversely affected, and the Canadian people have a heavy monetary interest in land transportation. What is proposed is that the taxpayer shall shoulder a new and enormous financial burden, in order to facilitate competition with a service which is already costing him many millions of dollars.

Canada has already gone far in providing the western producer with a low rate of transportation by rail. The western producer is the sole beneficiary under this artificial rate, and he is little concerned, relatively, with the effect upon its position as a taxpayer; the loss, if any, is borne by others. The St. Lawrence Waterway advocates now propose to benefit him still further, according to their calculation, by means of a huge national expenditure which the taxpayers will be called upon to carry; and again there comes the pertinent reminder that most of the taxpaying is done in other parts of Canada. The total annual bill which someone must pay is not taken into these calculations.

The foregoing statements and opinions carry the history of the negotiations of the St. Lawrence Waterway project up to the end of March, 1929. They are expressions of widely different views, and show a broad divergence of thought. They provide the reader with material that enables him, in some measure, to look at the project from a number of different angles, and to draw conclusions and form opinions for himself.

Chapter VI

THE CANALS OF CANADA AND THE UNITED STATES

When we build, let us think that we build for ever. Let it not be for the present delight, nor for present use alone, let it be such work as our descendants will thank us for, . . . and that men will say . . . "See! this our fathers did for us."—John Ruskin, *Seven Lamps of Architecture.*

O, it is excellent
To have a giant's strength, but it is tyrannous
To use it like a giant.—*Measure for Measure.*

A slender acquaintance with the world must convince every man that actions not words are the true criterion of the attachment of friends.—George Washington.

Chapter VI

(*a*) The Canals of Canada [1]

In the early part of the nineteenth century the people of Canada realized that, great as were the natural advantages afforded by the St. Lawrence system of lakes and rivers, these advantages could never be of the maximum benefit without the expenditure of large sums of money on improvements. At intervals along the route swift rapids or tumbling cataracts impeded the progress of inland navigation. Up these no craft could ascend, and but few sailors were willing to risk the descent of any but the less precipitous rapids. At most of them resort had to be made to the laborious task of portaging. Even with the birch bark canoe carrying the minimum of baggage and supplies, this was a trying ordeal for men of even the strongest physique.

When settlement of the upper country added to the volume of water-borne traffic and necessitated the use of larger craft, it became imperative that canals should be constructed if the country were not to be retarded in its development. The position at the time was that for navigation up the St. Lawrence as far as Lake St. Peter, there was a channel deep enough for the largest ocean vessels, but in portions of the lake a depth of only about 11 feet was available during the low water season. This was sufficient for the small vessels used for many years, but towards the middle of last century,

(1) *Canada and Its Provinces,* Vol. 10; *Annual Report of the Department of Railways and Canals,* 1928, and the *Report of the International Joint Commission.*

dredging became necessary to enable ocean vessels to reach Montreal.

Some eight miles above Montreal were the celebrated Sault St. Louis or Lachine Rapids. These were impassable for boats and, consequently, one of the first public works of any magnitude to be undertaken by the British after their occupation, was the building of a canal to enable shipping to go round them. A few miles above Lachine came three rapids, the Cascades, the Cedar and the Coteau, in quick succession. Next, some thirty miles further up the river, were the well known Long Sault Rapids. Then came rapids of a less formidable character; at Farran Point, Rapide Plat, Pointe aux Iroquois, Point Cardinal and the Galop. The growing trade between the upper and the lower province made it necessary that canals should be built to overcome all these unnavigable stretches.

Proceeding westward across Lake Ontario and through the Niagara River, the next hindrance to navigation was encountered. This was the most formidable obstacle of all—the Falls of Niagara, and to avoid these a canal about 27 miles in length had to be built. From the Falls to the entrance to Lake Superior no impediments to navigation occur, except a few shoals in Lake St. Clair. But in the St. Mary's River, as if guarding the entrance to the greatest of the Great Lakes, are the St. Mary's Falls and Rapids. This is the last of the obstructions to navigation in the St. Lawrence system, and here the last canal necessary to open navigation to the head of Lake Superior had to be built.

The French had done practically nothing towards the improvement of the waterway during their occupation of Canada, and there was really little reason why they should have

constructed canals. South and west of Montreal was a wilderness, and the fur trade that found its outlet through the Ottawa River was hardly large enough to warrant any considerable expenditure on their construction.

That the rulers of New France remained inactive was not through any lack of persuasion and example. The Sulpicians had begun the improvement of the Little St. Peter River on the island of Montreal from its mouth to Lake St. Louis and the construction of a canal from here to a point above the worst part of the Lachine Rapids. Dollier de Casson, the superior of the Sulpicians, let the contract for the excavation of a canal about a mile in length, 12 feet wide at the surface, and having a depth of 18 inches at low water in the St. Lawrence. Work was begun in the autumn of 1700, but the contract was never completed. The contractor became bankrupt in the following year; not, however, before he had excavated the amount required, with the exception of a cut three or four feet deep for a distance of a little less than half a mile.

The surplus revenue of the Sulpicians was never sufficient to complete the canal, but the French authorities hoped some day to be able to finish it. Louis XIV ordered plans and estimates for the work to be made in 1708, but the money to carry them out was not forthcoming. In 1714 Michel Bégon, the *intendant,* urged upon the King the necessity of finishing the work so that the marble from a quarry discovered near the Long Sault could be made available for use above the rapids, but it was said that the cost would be prohibitive. Gaspard Chaussegros de Léry, a French civil engineer, in 1717, reported that only about one-quarter of the whole canal remained to be finished, but the question of com-

S.S. *Rapids King* shooting Lachine Rapids

Courtesy Canada Steamship Lines, Ltd.

pleting it was again deferred until 1733, when the same engineer submitted new plans for a canal with locks costing 255,000 livres. The question of funds, however, was still acute, and it was impossible for the project to be completed.

The work of canalizing the St. Lawrence was, therefore, left for the British. Under the new order of things two interests insisted upon the work, the military and the commercial. The frontiers of Upper Canada were most exposed to attack, and to provide for their defence it was necessary to have free and unimpeded navigation from Lower Canada to the seat of danger. The St. Lawrence canals thus became one of the chief objects of concern to the British Governors and, up to the second decade of the nineteenth century, the British Government either constructed, or made substantial contributions towards the building of canals that would be useful for military as well as for commercial purposes.

The inhabitants of the two provinces were fully aware of the importance of canals to the trade development of the country, and from time to time investigations were made into the feasibility and cost of improving water communication. In 1818 the Governments of Upper and Lower Canada appointed a joint commission to report on the advisability of building canals on the St. Lawrence River above Montreal. Other commissions were appointed later, the most important one being in 1821 by the Government of Upper Canada; also, one in 1833 by the Government of Lower Canada. When the Union was being effected, it was apparent to all that the encouragement of trade between the two Canadas, by providing a navigable waterway between them for lake-going vessels, would avail more towards the solidification of

the interests of the two provinces than would any Act of Parliament.

Lieut.-Colonel George Phillpotts of the Royal Engineers, was directed by Lord Durham to report on the canal navigation of the two provinces in 1839. He submitted two reports, one in 1839 and the other in 1840, recommending the enlargement of all the canals between Lake Erie and tidewater, and proposing as the standard size lock that which had been used in the then partially completed Cornwall Canal, namely, 200 feet in length, 55 feet in width, and with nine feet of water on the sills. Although all the recommendations of Lieut.-Colonel Phillpotts were not acted upon, the building of canals after the Union was proceeded with in a vigorous manner.

As the united provinces had endeavored to improve the means of water communication, so the confederated provinces in 1867 concentrated their attention upon the improvement of the inland waterways. By 1867 commercial motives had almost entirely displaced military motives as incentives to the building and the enlargement of canals. The growth of lake traffic and the increase in the size of steamers, made some action towards the improvement of Canadian canals imperative.

As a preliminary to the commencement of this work, the Government in 1870 appointed a canal commission, which submitted a report in 1871 advising a uniform enlargement of the navigable waters from Lake Erie to tidewater, with the use of canal locks 270 feet long, 45 feet wide, and with a 12 foot depth of water on the sills. Plans for the enlargement of existing works on this basis were approved in 1873, and the work was begun.

In 1874, after an organized movement among the leading business men interested in inland navigation, strong representations were made to the Government to increase the depth of the canals to 14 feet instead of 12 feet, as recommended by the commission. This request was granted in 1875, and orders were given for the permanent structures of those works that had not been placed under contract to be built to the enlarged scale.

The St. Lawrence River Canals

The canals on the St. Lawrence already built by the British were mainly for military purposes. They were four in number, and were designed to overcome the rapids at the Cascades that were later surmounted by the Beauharnois Canal. Work on them was begun in 1779 by Captain Twiss of the Royal Engineers, who was acting under orders from Governor Haldimand. Cornish miners were brought from England to do the rock cutting.

The first canal, constructed at the Faucille Rapids, a short distance above Cascades Point, was 400 feet long and six feet wide, and was equipped with one lock. The second, of the same width, was at the Trou du Moulin, near the mill owned by the Baron de Longueuil. It consisted of a cut some 200 feet long, but without any locks. At Split Rock Rapids, advantage was taken of a natural opening through the rocky shore, known as the Split Rock. This passage was 200 feet long and was equipped with one lock, the sides of which were formed by the natural walls of the channel.

The last and most important cutting was at Coteau du Lac. It had three locks, and was 900 feet long by seven feet in width. This series of canals was thus about 1,700 feet in length, with five stone locks, each six feet wide, with the

exception of those at Coteau du Lac, which were seven feet. The locks had a depth of two and a half feet on the mitre sills, and were designed for small boats carrying from thirty to forty barrels of flour. The toll charged was twenty-five shillings for each boat, except for those of the King, which passed free. The total number of craft making use of them at the time of their completion was about 260 a year.

The operation of these canals did not prove as successful as was anticipated, the two lower ones being damaged by ice each spring. In 1800 Colonel Gother Mann of the Royal Engineers was authorized to make a report regarding them, and he recommended that the depth of all should be increased by 18 inches. Owing to the risk of damage by ice to the canals at the Cascades and at the Mill Rapids, and the resulting heavy expense of maintenance, he advised that one new canal should be built to avoid both rapids. He proposed the enlargement of the gates at the Coteau du Lac and at Split Rock to nine and a half feet, and the cutting of an additional breadth of two feet to the canals and four feet to the locks.

Colonel Mann made a recommendation that the new canal should be 1,500 feet long, and that it should be provided with three locks, each 20 feet wide and 120 feet long, sufficient to accommodate six boats at a time. The expense, he estimated, would be partially offset by about £600 annually expected to be received from tolls. The new canal was completed in 1805, the old one being used during its construction to prevent interruption to navigation.

To-day, the canal system of Canada comprises a series of canals and canalized waters by which a total waterway of 1,831 miles has been opened to navigation. These canals fall into two main classes, (1) the through St. Lawrence and

Great Lakes route, and (2) the subsidiary canals or branches. By the former, communication with seaports is made possible for vessels of not more than 14 feet draft which navigate the Great Lakes. The latter, or branch system of canals, serves for the most part the requirements of a merely local traffic.

The through water route between Montreal, at the head of ocean navigation, and Fort William and Port Arthur, on the west shore of Lake Superior, comprises 74 miles of canal, with 49 locks and 1,140 miles of river and lake waters, or a total of 1,214 miles. The minimum depth of water on this route at normal low water level is 14 feet. From Montreal to Duluth, at the south-west end of Lake Superior, the total distance is 1,337 miles, and to Chicago 1,244 miles. Connection is made with the Canadian Pacific Railway from points west and south at Fort William and Port Arthur, which cities are six miles apart.

From Fort William, connection with the main transcontinental line of the Canadian National Railways is made by the branch line originally constructed by the Grand Trunk Pacific Railway, but now operated by the Canadian National Railways. At Port Arthur, the Canadian National Railways have an additional connection with points west and south via the old main line of the Canadian Northern Railway.

(1) Lachine Canal

This canal, which lies across the south-east portion of the island of Montreal, overcomes the Lachine Rapids, between the harbor of Montreal and Lake St. Louis. It is eight and a half miles in length, has five locks measuring 270 by 45 feet, and the total rise of lockage is 45 feet. The depth of water on the sills at three of the locks is 14 feet and

at the remaining two 18 feet. The average width of the canal is 130 feet.

What the Sulpicians had long hoped for, and what the French King had put off until the day should come when France would have a full exchequer, was destined never to be accomplished during the French occupation. The building of the Lachine Canal was left for British energy and enterprise. The increase of trade with the upper province after its settlement by the United Empire Loyalists, made the building of a canal at the Lachine Rapids one of pressing concern.

Adam Lymburner, a Quebec merchant, urged the building of the canal in 1791, pointing out that the cost of carting goods from Upper Canada past the rapids would "fall very heavy on the rude produce of the lands." In 1815 the Legislature of Lower Canada passed an Act appropriating £25,000 for the purpose, and entrusting the execution of the work to commissioners appointed by the Government. Captain Samuel Romilly of the Royal Engineers, made a report upon the project in 1817, and he estimated that a canal with a depth of three feet of water, and capable of passing Durham boats 60 feet long, 13½ feet wide, and drawing 30 inches of water, would cost slightly over £46,000 Halifax currency, which at that date amounted to approximately £36,800 sterling.

No steps, however, were taken to carry out the provisions of the Act, and on January 18, 1819, a petition signed by a large number of the leading men of the province, asking that they be incorporated for the purpose of building the canal, was presented to the Government. This request was acceded to and a company, known as "The Company of the Proprie-

tors of the Lachine Canal," was created with a capital of £150,000, divided into shares of £50 each. The British Government, recognizing the value of the canal from a military point of view, subscribed for 600 shares, while the Provincial Government subscribed for 200 shares.

The canal was to be completed in three years, and was to be navigable for vessels drawing at least five feet of water. It was to be not less than 40 feet wide at the surface, and 28 feet at the bottom, while the locks were to be 100 feet long by 22 feet wide. Tolls were fixed, ranging from twelve shillings and sixpence for vessels under five tons burden up to thirty shillings for vessels of over sixty tons burden and, in addition, the sum of five shillings was to be paid for each ton of merchandise carried. If the tolls were found to be excessive the Legislature, at the expiration of two years, had power to reduce them to such an extent as to limit the earnings of the company to not more than 15 per cent. on the capital outlay. Provision was also made that the King could take possession of the canal at any time, either before or after completion.

But the prospects of the canal did not seem to be any brighter than they had been under Government direction. The company engaged Thomas Burnett, an engineer from England, to make a survey and estimate the cost, and expended in all £2,058 in preliminary work. On January 8, 1821, the company petitioned the Government to the effect that only 1,780 of the original 3,000 shares had been subscribed. It asked that the Government should make certain amendments to the Act under which the company had been incorporated, extend the three year time limit set for the completion of the canal, and take an additional number of

shares in the enterprise. The Government replied by repealing the Act, buying out the company for the sum it had expended in development work, and itself undertaking once again the building of the canal. Commissioners were appointed in 1821, with John Richardson as chairman to superintend the work, and construction was rushed with a gang of nearly 400 men.

As originally projected, the canal was to run from Lachine to the foot of the current of St. Mary, but the high prices asked for land on this section of the route led to the terminus being placed some three miles higher up where the current was swifter. The canal as built was almost nine miles long, with a bottom width of 28 feet and 48 feet at the surface. Where it passed through rock it was made 36 feet wide at the water surface. It was provided with seven locks of cut stone, each 100 by 20 feet, with a depth of five feet. The canal was opened in August, 1824, but vessels did not pass through until the following year, as the shipping companies had previously contracted for the carriage of their goods over the portage for the year 1824.

The expense of construction, amounting to £109,601, was borne by the Government of Lower Canada, with the exception of £10,000 contributed by the British Government on condition that their vessels and military stores were allowed to pass free of toll.

An agitation for the enlargement of the canal, which began prior to the union of the two provinces in 1841, led to the appointment of Lieut.-Colonel Phillpotts to report on the canal navigation of the country. He advised that a new cutting should be made for the Lachine Canal. This should be commenced, he recommended, at Leishman's Point, about

half a mile higher up the river than the one then in use, and should be continued for the greater part of the route. The size of the locks was to be the same as those recommended for the whole Canadian canal system.

According to Lieut.-Colonel Phillpotts's plan, however, the number of locks would be reduced from seven to six. The estimated cost of the improved canal was £324,600. Immediately after the Union, the engineers of the Board of Works made an estimate of the cost of improvements on all the canals that were necessary for the accommodation of lake-going vessels and, disregarding Lieut.-Colonel Phillpotts's recommendations, advised the retention of the old route for the Lachine Canal.

Work on the enlargement was begun in 1843, and the improved canal was opened in 1848. The number of locks was decreased to five, each being 200 by 45 feet, with nine feet of water on the sills, except in the case of the first two which, on the urgent representations of the merchants of Montreal, were deepened to 16 feet in order to allow the largest ocean-going vessels to enter the first basin of the canal.

As a result of the findings of the commission in 1871, the canal was again enlarged. It was first built with locks giving a depth of 12 feet, although the permanent structures were designed for 14 feet. The present canal was opened in 1901 for the use of vessels having a draft of 14 feet. Its locks are electrically operated and it is lighted by electricity. The old canal, with locks giving a depth of nine feet, runs parallel with the new one and is still available for use.

(2) Beauharnois or Soulanges Canal

The length of the Soulanges Canal is 14 miles, and it has four lift and one guard locks. These are 280 feet by 45

feet, and the total rise of lockage is 84 feet. The depth of water on the sills is 15 feet, the width at the bottom 100 feet, while the width at the surface of the water is 164 feet.

After leaving the Lachine Canal, and sailing in a southwesterly direction across Lake St. Louis, a series of three rapids, the Cascades, Cedar and the Coteau, are encountered before Lake St. Francis is reached. This swift water extends over a distance of about 11 miles, but there are only some seven miles of actual rapids, the spaces between consisting of quiet stretches easily navigated. As previously stated, the navigation of this portion of the river was made possible by four canals built under the supervision of the Royal Engineers between 1779 and 1783, the locks at Split Rock and Coteau du Lac being replaced in 1804 by a single new canal. Later, in 1817, the width of these canals was doubled, and their depth increased to three and a half feet, in order to admit Durham boats and *bateaux* capable of carrying a hundred barrels of flour.

This improvement, however, did not long meet the needs of the traffic, and in 1833 the Government of Lower Canada appointed commissioners to investigate the navigation of this portion of the St. Lawrence River. In 1834 their engineer, John B. Mills, submitted three plans, each of which contemplated a canal on the north shore. The one he recommended advised the building of three short canals, and the utilization of the two navigable stretches of calm water between the rapids. This plan was approved by a special committee of the Legislative Assembly, which recommended that a grant of money should be made to carry it out, but no further action was taken at that time.

In 1834 Alexander Stevenson submitted a plan to Parliament for building a canal on the south shore of the river, and further plans for a canal on this side were presented in the following year. The work was still unattempted in 1839, when Lieut.-Colonel Phillpotts made his report to Lord Durham on canal navigation in Canada. While conceding that a canal on the south shore would cost less than one on the opposite shore of the river, he considered the former undesirable from a military point of view, and he adhered to John B. Mill's plan of 1834.

After much discussion the Beauharnois Canal was finally built on the south shore. The contracts were let in 1842, and the work was finished by the close of the navigation season in 1845. The length is 11¼ miles and there are nine locks, each 200 by 45 feet, with a depth of nine feet of water. The upper entrance was a difficult one through a rocky channel beset with dangerous currents and, after the steamboat *Magnet* was sunk in 1849 by being carried past the entrance and striking the rocks, considerable expenditures were made to improve the approach.

The Beauharnois Canal is no longer used for navigation, the Soulanges Canal, the dimensions of which are given in the opening paragraph of this section, having taken its place. This canal has fewer locks and is built on the north side of the river. Its construction was decided upon in 1891 and the work was completed in 1899.

(3) Cornwall Canal

From the head of the Soulanges Canal to the foot of the Cornwall Canal, there is a stretch through Lake St. Francis of 31 miles, which is navigable by vessels drawing 14 feet of water. It extends past the Long Sault Rapids from the

town of Cornwall to Dickinson Landing, a distance of 11 miles. There are six locks and a guard lock, 270 by 45 feet, and the total rise of lockage is 48 feet. The locks have a depth of 14 feet of water on the sills, and the width of the canal at the bottom is 90 feet, with a width of 154 feet at the water surface.

The question of building a canal round the Long Sault Rapids was discussed in the Legislature of Upper Canada in 1816, and in 1818 it was one of the subjects dealt with by the joint commission appointed by the Governments of Upper and Lower Canada to report on the water communication of the upper St. Lawrence. Canals not less than four feet deep, to cost $600,000, were recommended. Nothing was done, but the subject was not allowed to lapse. In 1826 the Lieut.-Governor submitted a report by Samuel Clowes which outlined two plans; one for a canal with a depth of eight feet, and the other being for a four foot waterway.

At this juncture the town of Brockville took up the matter. The opening of the Rideau-Ottawa system of canals drew traffic away from the St. Lawrence, and the commercial life of the town was threatened. In 1830 Brockville undertook a preliminary survey for a canal between Cornwall and Dickinson Landing and, in the interests of the project, brought pressure to bear on the authorities. The result was that in 1832 a resolution was passed favoring the construction of a canal with a depth of nine feet. Commissioners were appointed in 1833 to carry on the work. Two engineers, Benjamin Wright and John B. Mills, were employed to make a report, and they submitted plans for the Cornwall and the Williamsburg Canals involving an estimated expenditure of £350,000.

Work was begun on the Cornwall Canal in 1834, but the outbreak of the rebellion in 1837, together with the financial depression, caused a complete cessation of work for some years. Indeed, construction was not resumed until 1842, and it was not until the year following that the canal was opened for navigation. It had six locks, each 200 by 55 feet, and nine feet deep, these dimensions being the largest of any canal in Canada until after Confederation. As a result of the findings of the canal commission of 1871, it was decided to enlarge the Cornwall Canal together with the other St. Lawrence canals. The enlargement, giving a 14 foot depth of water, was not completed until 1900.

(4) Williamsburg Canals

Five miles above the Cornwall Canal is the Farran Point Canal which, together with the canals at the Rapide Plat and the Galop, constitute what are known as the Williamsburg Canals. The rapids they overcome are not particularly strong, and passenger steamers navigate them both ways. Although the building of these canals was proposed at various times before the Union, their construction was not begun until 1844. That at Farran Point was completed in 1847. It was three-quarters of a mile long and had one lock, 200 by 45 feet, with nine feet of water on the sills.

The Rapide Plat Canal is nine and a half miles further up the river. It had two locks of the same dimensions as that at Farran Point. Work on it was begun in 1844 and it was opened in 1847.

The Galop Canal avoids the rapids at Pointe aux Iroquois, Point Cardinal and the Galop. Originally, there were two canals at this point, the Iroquois and the Galop, separated by a distance of two and a half miles. The Galop

Canal was opened for navigation in 1846 and the Iroquois in the following year. Owing, however, to an error of level, it was found that the latter had not a sufficiency of water, and it became necessary to build the Junction Canal to join the two first built. The cost of the engineer's miscalculation was $211,231. These three canals form what is now called the Galop Canal. They have been deepened in accordance with the plan adopted in 1875, but the enlargement was not completed until 1903.

To-day, the Farran Point Canal, which lies five miles west of the Cornwall Canal, has a length of one and a quarter miles. It has one lock measuring 800 by 50 feet, the rise of lockage being only three and a half feet. The lock has a depth of 14 feet of water on the sills, the width at the bottom is 90 feet, and at the surface of the water 154 feet.

The Rapide Plat Canal extends from the town of Morrisburg to Flag's Bay. It lies nine and a half miles above the Farran Point Canal. It is three and three-quarter miles long, has two locks each 270 by 45 feet, the total rise of lockage being 11½ feet. There is a depth of 14 feet of water on the sills, the width at the bottom is 80 feet, and at the water surface 152 feet.

The Galop Canal lies about four and a half miles west of the Rapide Plat Canal, and it extends from the village of Iroquois to a point about one and a half miles above the town of Cardinal. It is seven miles long and has three locks, the lift lock at the foot of the canal being 800 by 50 feet, the guard lock at the head of the canal 270 by 45 feet, and the lift lock to pass vessels round the Galop Rapids only, 303 by 45 feet. The total rise of lockage is 15½ feet, the depth

of water on the sills 14 feet, the width of the canal at the bottom 80 feet, and at the surface of the water 144 feet.

(5) Welland Canal

The building of the first Welland Canal was mainly due to the enthusiasm and untiring efforts of William Hamilton Merritt who, in 1824, organized the Welland Canal Company. This was shortly before the opening of the Erie Canal. The Company was incorporated with a capital of £40,000, and the original intention was to build the canal for boats of four foot draft, a burden of not more than 40 tons, and to tunnel under the high ridges, but this latter scheme was abandoned as impracticable.

The Government of Upper Canada, although it had declined to undertake the building of the canal as a Government measure, subscribed liberally to the stock of the Welland Canal Company, as did also the British Government. The work was rapidly pushed forward, and towards the end of 1828 it was almost completed, when a mile or more of the high bank in what was known as the "Deep Cut" fell in and destroyed a considerable portion of the canal. The British Government came forward immediately with a loan of £50,000, and the canal was finally completed and opened in 1829.

The first Welland Canal had 40 wooden locks, 110 feet long, 22 feet wide, with eight feet of water on the sills. On the Union of Upper and Lower Canada in 1840, the Government took over the canal and replaced the 40 wooden locks with 27 stone locks ranging in length from 150 to 230 feet, with a width of from 26½ to 45 feet, and a depth of 10¼ feet of water on the sills.

In 1871, the original canal having been found to be inadequate for the traffic, it was decided to build a new one from Allanburg to Port Dalhousie, a distance of almost 12 miles. Twenty-five masonry lift locks with uniform dimensions of 370 feet were provided, with a depth of 12 feet on the sills, but before the work had proceeded far it was decided to make all permanent structures adaptable to a 14 foot depth throughout. It was not, however, until 1887 that the canal was finally completed to that depth.

As the country had outgrown the original canal, so in course of time it outgrew the capacity of the second one, and towards the end of 1913 the Government began the construction of a third canal of sufficient capacity to accommodate the largest vessels likely to be built for service on the Great Lakes. The new canal leaves Lake Ontario at the original mouth of Ten Mile Creek, now known as Port Weller, about three miles east of Port Dalhousie, where a harbor of entry has been constructed, and it follows an entirely different route from the present canal as far south as Allanburg.

From this point it proceeds in general along the line of the existing canal to a point about one mile north of the village of Humberstone, where another division, about two and a half miles in length, is made to the east of the present waterway. The route of the old canal is then followed for the final half mile to the Lake Erie entrance at Port Colborne. The total distance traversed from lake to lake is 25 miles. The difference in level between the two lakes, 325½ feet, will be overcome by seven lift locks, all of which are now well advanced towards completion, each having a lift of 46½ feet, and one guard lock of variable lift. The locks are 829

by 80 feet in the clear, and will provide a depth of 30 feet of water over the mitre sills. The new breakwater, now practically finished, at Port Colborne, extends 2,000 feet further into the lake and at right angles to the existing structure. At Port Weller, the Lake Ontario entrance, the extensive harbor works are now almost completed.

In 1914 the cost of the new Welland Canal was estimated at $50,000,000, and it was anticipated that it would be constructed in about four years. The war, however, upset all calculations and caused serious delay. Up to the end of 1916 the Government had expended a total sum of $10,147,-801. Work was actively going on in 1919 and proceeded steadily throughout that and the following year. The old canal admitted vessels of 2,500 tons, whereas the new one when completed will accommodate vessels up to 10,000 tons. It is expected to be ready in 1930, and the estimated cost is between $115,000,000 and $120,000,000, or almost two and a half times the amount of the original estimate.

In the main estimates for the fiscal year ending March 31, 1930, which were tabled in the House of Commons on February 18, 1929, by the Hon. James A. Robb, Minister of Finance, there was a request for $10,000,000, which is presumably the last item in the estimates for this great waterway, although it is expected that some $5,000,000 additional will be required for completion. Up to December 31, 1928, a total of $100,700,000 has been spent on the new canal. (1)

With the approach of the completion of the Welland Canal, the necessity for establishing grain transfer and storage elevators and docks at the foot of Lake Ontario, for the transfer of grain from large lake freighters to St. Lawrence

(1) *The Gazette,* Montreal, February 20, 1929.

vessels, gradually became apparent. In September, 1926, therefore, the Government took preliminary action by appointing a committee to study the new project that had arisen. This committee consisted of:

S. J. Chapleau, Engineering Branch, Department of Public Works, Chairman;

D. W. McLachlan, Department of Railways and Canals;

R. A. C. Henry, Director of the Bureau of Economics, Canadian National Railways, representing both the Canadian National Railways and the Canadian Pacific Railway.

This body entered upon its duties by commencing a study of the relative merits of Kingston, Brockville and Prescott as points of transhipment. In June, 1928, the Hon. J. C. Elliott, Minister of Public Works, during consideration of his estimates in the House of Commons, stated that the Government had decided, following the recommendation of the committee, to place the terminal at Prescott. The sum of $1,500,000 was voted as a progress appropriation, the ultimate cost of the terminal being estimated at $4,000,000.

Towards the end of January, 1929, a press despatch from Ottawa reported that a contract had been let to the Thunder Bay Improvement Company of Fort William, for the construction of a wharf and foundation for a terminal elevator at Prescott. The tender was for approximately $500,000, the lowest of the twelve submitted. On February 7, it was further reported that the work of placing the pile foundations and revetments would be commenced on February 11, and that it must be completed by the early summer. At the same time, it was announced that public tenders were expected to be called for in connection with the dredging and filling necessary to permit of the construction of a 5,000,000 bushel

elevator and concrete wharves on the pile foundations then under contract.

That a new era may be dawning for Kingston is foreshadowed by a definite proposition for the erection here of a 4,000,000 bushel elevator. Such a proposition was made to the city authorities during the first week in March, 1929, by the Canada Steamship Lines, which company announced that it was prepared to assume responsibility for the building of such an elevator provided the city would furnish a suitable site and arrange with the Federal Government to do the necessary dredging. The company urged that no time be lost in arranging for the carrying out of the entire project, including docks, wharves, dredging and elevator.

The elevator would handle the transference of the western grain that must be taken to Montreal in smaller vessels owing to the shallower canals along the St. Lawrence River. The 500 and 600 feet steel vessels which now carry grain from Fort William and Port Arthur to Port Colborne will, with the new Welland Canal, come to Kingston to discharge their cargoes. The work on this elevator is now proceeding. (1)

A comparison between the new Welland Canal and existing canals used by large vessels is shown in the following table: (2)

	Length miles	Depth feet	Width feet
Manchester Ship Canal	35	28	120-180
Kiel Canal	61	36	145
Suez Canal	102	36	137
Panama Canal	50	41	300-1,000
Houston Ship Channel	50	25	100-150
Sabine-Neches Canal (to Beaumont and Orange, Tex.)	49	23	125
Welland Canal	25	25-30	200
Amsterdam Canal	15	32	164-197

(1) *The Gazette,* Montreal, January 23, February 7, March 9 and 11, 1929.
(2) *Transportation Economics of the Great Lakes-St. Lawrence Ship Channel,* by Alfred H. Ritter, p. 18.

From the above it will be seen that the new Welland Canal will be wider than any of the important ship canals except the Panama Canal.

(6) Sault Ste. Marie Canal

This canal provides communication between Lakes Huron and Superior, surmounting by a single lock the rapids of the St. Mary's River. It is 1-1/3 mile in length and lies entirely within Canadian territory.

The slow development of commerce on Lake Superior was responsible for the comparatively recent construction of this canal. There are, however, the almost obliterated remains of a small canal with a wooden lock that was built towards the close of the eighteenth century by the North-West Company to accommodate their fur boats. The survey for this was made in 1797, and the canal which resulted was about half a mile in length, while the lock with which it was provided was 38 feet long, about nine feet wide, with a lift of nine feet.

Although in 1851 and 1852 several petitions by private individuals were presented to Parliament asking for the incorporation of companies to build a canal to connect Lake Superior and Lake Huron, the project was not begun until after the completion in 1855 of the canal on the United States side of the river. A survey of the ground was made by the Dominion Government in 1887, and contracts for the construction of the canal on St. Mary Island were let in 1888 and 1889. The initial plan was that the single lock to be built should be 600 feet long and 85 feet wide, with a depth of 16½ feet of water on the sills at the lowest known water level.

But the possibilities of the west as a wheat producing country were forcing themselves upon shipowners, who

brought pressure to bear upon the Government to increase the lock dimensions. The result is that the present length of the lock is 900 feet, the width 60 feet, and the depth of water on the sills 18¼ feet, at the lowest water level. This large lock allows several vessels to pass through at the same time. The canal was opened for navigation in 1895, and the increase of traffic through it, due largely to the development of the west, has increased at a rapid pace.

Ottawa and Rideau Rivers Canals

(1) St. Anne Lock

The Ottawa-Rideau Canals establish water communication between Kingston and the lower St. Lawrence by way of the city of Ottawa. With the exception of the rapids at its mouth and at Carillon, Chute à Blondeau and Grenville, the Ottawa River is navigable as far as the Chaudière Falls at the city of Ottawa. Navigation from there to Kingston has been obtained by canalizing the Rideau and Cataraqui Rivers, and by making use of the Rideau Lakes. The distance from Kingston to Montreal by this route is 246 miles, and by the St. Lawrence River 178 miles.

On this account, and also because of the large number of locks to be passed on the Rideau Canal, this route has never been able to compete successfully with the St. Lawrence. The idea of a commercial waterway, however, was only incidental to that of a military water highway in the minds of the promoters of the project. The works were constructed at the expense of the British Government, and were carried out under the direction of the Royal Engineers.

While this latter statement is true of the Rideau and Ottawa Canals, it does not apply to the lock at St. Anne. This surmounts the St. Anne Rapids between Ile Perrot and

the island of Montreal, at the junction of Lake St. Louis and the Ottawa River. It consists of two parallel locks, the old and the new, each with a lift of three feet. The old lock, now disused, has a depth of only six feet, but in the new lock there is a depth of nine feet of water on the sills.

Although the various channels connecting Lake St. Louis with the Ottawa River were not all impassable in their natural condition, the navigation of this stretch of water had long remained a problem for vessel owners. During the early years of the nineteenth century the channel between the west side of Ile Perrot and the mainland was utilized, but only by means of a windlass placed on a pier near Vaudreuil, a short distance above the rapids.

By the use of this windlass vessels were wound up the channel to Lake of Two Mountains. In 1816 the St. Andrews Steam Forwarding Company built a wooden lock at this point but, as they wished to secure a monopoly of the Ottawa River traffic, only their own vessels were allowed to use it. The windlass, therefore, continued in operation after the completion of the lock. This monopoly was broken up when a navigable channel through the rapids was discovered. The first lock to be built was only capable of passing a 20 h.p. steamer; but in 1833, after it had been acquired by the Ottawa Forwarding Company, it was rebuilt of wood.

The policy followed by the owners of this private lock became so injurious to trade that the Legislature of Upper Canada made representations on the subject to the Government of Lower Canada and, as a result, in 1840, the latter province began the construction of a lock. After the Union, the Government took charge of it and completed it in 1843. The lock was 190 feet long by 45 feet wide, with six feet of

water on the sills at low water. In 1882 a new lock was built with a length of 200 feet, 45 feet in width, and with nine feet of water on the sills.

(2) Carillon and Grenville Canals

From St. Anne lock to the foot of the Carillon Canal, there is a navigable stretch of water 27 miles in length through Lake of Two Mountains and the Ottawa River. The Carillon Canal, which is three-quarters of a mile in length, with two locks, giving a total lift of 16 feet, surmounts the next rise in the river level produced both by the Carillon Dam at the head of the canal and the natural fall of the river below. The Long Sault Rapids, six miles above the Carillon Canal, are surmounted by the Grenville Canal, five and three-quarter miles in length, with five locks. Both these canals provide a depth of nine feet of water over the lock sills.

Captain J. F. Mann of the Royal Engineers, surveyed the Ottawa River in 1818, and recommended the building of these canals at an estimated cost of £16,740. They were designed by the British Government in 1819 on the scale of the Lachine Canal, but in 1828, before their construction was completed, it was decided to increase the size in order to make them more in harmony with those on the Rideau. The depth of water in them was six feet.

Unfortunately, there were in the Grenville Canal a number of small locks, and the smallest of these, 107 by 19 feet, determined the size of the vessels that could be used on the whole Ottawa-Rideau waterway. They have since been enlarged to 200 by 45 feet, and their depth has been increased to nine feet. On account of the canals being too small to accommodate the steamboats used on the Ottawa River, transhipment of passengers from Grenville to Carillon was

made by road, but later a short railway of some thirteen miles in length was built to do this work. It was purchased by the Ottawa River Navigation Company in 1859, and is operated only in summer in connection with their boats.

(3) Rideau Canal

This canal connects with the Ottawa River about 56 miles above the head of the Grenville Canal and provides a waterway between the cities of Ottawa and Kingston. It consists of a series of natural watercourses joined by artificial cuttings, is 126¼ miles long, and has 47 locks with a minimum depth of five feet over the sills. It rises by 33 locks to a summit in the upper Rideau Lake, from which body of water it descends by 14 locks to the level of Lake Ontario. A subsidiary canal, seven miles in length, known as the "Tay Branch," connects the town of Perth with the north end of the lower Rideau Lake. Its minimum depth is five feet.

The British Government began to look about for an alternative water communication between Upper and Lower Canada, and the most obvious route was by way of the Ottawa and Rideau Rivers. Lieut.-Colonel G. Nicolls, who commanded the Royal Engineers in Canada at that time, was directed to send an officer to report on the feasibility of the route. Captain Jebb was detailed to do the work, and he reported that the construction of a water route between Kingston and Ottawa by means of the Rideau and Cataraqui Rivers was practicable.

Nothing further was done, however, until 1821, when the Legislature of Upper Canada appointed commissioners to report on the subject of internal navigation. The British Government offered a loan of £70,000 to aid in opening water communication between Kingston and Ottawa, and in 1824

the commissioners engaged Samuel Clowes to make a survey of the ground. He submitted a report giving plans for canals of three different sizes; but the Legislature, being convinced that the Ottawa-Rideau route could never compete commercially with the St. Lawrence, decided not to act on any of these plans, and declined the proffered loan.

But the British Government considered the project to be of too important a nature from a military point of view to be abandoned. In 1825, therefore, a committee composed of members of the Royal Engineers was sent to Canada to report on the public works of the colony, and to submit an estimate for the cost of the Rideau Canal. Their calculation was that it could be built for the sum of £169,000, and at this figure the British Government decided to undertake the work. The size of the locks was to be 108 by 20 feet, with a depth of five feet of water on the sills. Lieut.-Colonel John By of the Royal Engineers, who had previously been in Canada, was appointed to superintend the construction, and work was begun in September, 1826.

Colonel By made a thorough examination of the proposed route, and in the autumn of 1827 he estimated that the canal would cost £474,000 instead of £169,000. This startled the British authorities, and a commission was appointed at once to examine the estimates and plans, Colonel By being ordered to suspend operations in the meantime. But he had done his work thoroughly; the commission could find little fault with his estimates, although they suggested that a saving in expense might be effected by lessening the thickness of the side walls, and by using wood instead of stone for the 36 locks on which construction had not been commenced.

Colonel By had strongly recommended that the size of the locks should be increased from 108 by 20 feet to 150 by 50 feet, in order to admit of steamboat navigation, but Sir James Carmichael Smyth, the administrator of Lower Canada, was opposed to this. A committee appointed for the purpose of deciding the question effected a compromise, recommending that the locks should be capable of passing a steamboat 108 feet long and 30 feet wide. Locks were built, therefore, 134 feet long by 33 feet wide, and the canal was opened for traffic in 1832.

The Tay branch of the Rideau Canal extends a distance of seven miles from Lake Rideau to the town of Perth. It was built in 1834 by a private corporation to which the Government had loaned money for the work, and originally afforded a depth of four feet. It was subsequently taken over by the Government, and has been dredged to afford a minimum depth of five feet.

The importance of the Ottawa-Rideau route from a commercial point of view has steadily declined with every enlargement of the St. Lawrence canals. Large quantities of logs and lumber pass down the Ottawa River every year for shipment to Europe, or to the north-eastern states of the United States via the Richelieu River and Lake Champlain. The traffic on the Rideau Canal is, however, small, and the destruction of the forests on the adjoining land causes an insufficient supply of water in summer which seriously interferes with navigation. Of recent years the Rideau route, on account of its beautiful scenery, has attracted many tourists, and most of the vessels using it are launches and other kinds of pleasure craft.

Richelieu River Navigation

(1) St. Ours Lock and Dam

At a point on the Richelieu River, 14 miles above the town of Sorel, the level of that river has been raised five feet by a dam. This difference in level is overcome by the St. Ours Lock. There is seven feet of water on the upper lock sills, but the depth on the lower sills is governed by the level of the St. Lawrence River, and has been as low as five and a quarter feet in October, 1923.

(2) Chambly Canal

Between the St. Ours Lock and Chambly Basin, a distance of 32 miles, the river is navigable with a depth of seven feet. The Chambly Canal, which enters at this point, is 12 miles in length and has nine locks. It surmounts all the rapids between Chambly and St. Johns, thus establishing communication with Lake Champlain. The locks, nine in number, provide a depth of six and a half feet of water over the sills. The canal passes through a country settled much earlier than that along the upper St. Lawrence; thus it was constructed long before the canals between Montreal and Prescott.

The first work on the Richelieu River was begun by the French in 1745 at Chambly Rapids. It consisted of removing some of the rocks to permit of the passage of masts and shipbuilding timber obtained from the Lake Champlain district. In 1787 Silas Deane, a native of Connecticut then residing in England, proposed to Lord Dorchester the building of a canal round the rapids at St. Johns to connect Lake Champlain with the Basin of Chambly.

Adam Lymburner made a similar proposal in 1791, his object being to facilitate the shipment of goods from New

York and Vermont to Quebec. He advocated a canal about six miles in length having a depth of seven feet. Ira Allen, in 1796, advocated the construction of the canal on political grounds, intimating that the friendliness of the State of Vermont to Britain would thereby be strengthened.

Work was commenced at St. Ours in 1830, and from that time until the Union, was carried on in an unsystematic way, one plan when partially carried out being abandoned for another. It remained for the Board of Works, formed after the Union, to complete the undertaking. The lock at St. Ours was finished in 1839, and the Chambly Canal was opened in 1843. It was improved in 1850, giving a navigable depth of slightly less than seven feet of water throughout. Connection with the Erie Canal is made from Lake Champlain by the Champlain Canal, a waterway built in 1822, which was originally four and a half feet deep, but which was later deepened to five feet.

The construction of railways has deprived the Richelieu of its importance as an avenue of trade, and this route is now used chiefly by barges carrying lumber from the Ottawa River down the St. Lawrence and through the Richelieu-Lake Champlain and Erie waterway to New York.

Lake Ontario to Georgian Bay

(1) Murray Canal

This canal, an open waterway 80 feet in width, with 11 feet depth at low water, across the isthmus of the Prince Edward County peninsula, connecting the Bay of Quinte with Lake Ontario, is without locks.

The first official notice of the project was given in 1796, when the Lieut.- Governor in Council set aside a grant of 3,000 acres of land for construction purposes. In 1815,

however, this land was surveyed and sold without any reference to the purpose for which it had been reserved. At various intervals the project was advocated and surveys made, but the contract for the work was not awarded until 1882. The canal was opened for traffic in 1890.

(2) Trent Canal

The route of the Trent Canal, as now in operation, lies between Trenton, on the Bay of Quinte, where direct connection is made with Lake Ontario, and Port Severn, on Georgian Bay, from which the waters of the Great Lakes are accessible. The canal is made up of a series of lakes and rivers connected by relatively short lengths of artificial cuttings. Connection between the water levels of the various reaches is effected by locks, except at Swift Rapids and Big Chute, where marine railways are employed.

The through route may be briefly described as follows: Between Trenton and Rice Lake the canal follows the line of the Trent River. Passing through Rice Lake it enters the Otonabee River, the route of which is followed to its source in Katchiwano Lake. From this lake the line of the canal passes in succession through Clear Lake, Stony Lake, Lovesick Lake, Buckhorn Lake, Pigeon Lake, Sturgeon Lake and Cameron Lake, to the west side of Balsam Lake.

From here connection is made by an artificial cutting with Mitchell Lake about two miles westward, and from the latter lake another cutting makes connection with Cranberry Lake. From the south end of Cranberry Lake, connection is made with Lake Simcoe by another artificial cutting. Passing through Lake Simcoe, the route of the canal continues to the Severn River, the line of which is followed to the Georgian

Bay outlet at Port Severn. From Trenton the canal rises to a summit at Balsam Lake, the level of which is about 597 feet above that of Lake Ontario. From Balsam Lake to Georgian Bay there is a fall of 262 feet. The total length of the route from lake to bay is about 240 miles. It is made up of two main divisions: the eastern division, between Trenton on Lake Ontario and the outlet of Lake Simcoe, and the western division, from Lake Simcoe to Georgian Bay.

Eastern Division (Lake Ontario to Lake Simcoe).—This division includes, in addition to the main route of the canal, the Scugog branch, 35 miles in length, from Sturgeon Lake to Port Perry via the Scugog River and Lake, and various other navigable channels aggregating in all about 60 miles. The total extent of canal and canalized waters maintained in operation on this division is, therefore, about 240 miles. There are 42 locks and lock structures, two of which are hydraulic lift locks, eight guard gates, 47 bridges, seven emergency dams, 40 lockhouses, 30 watch-houses, and 24 storehouses. Included also under this division are various reservoir lakes and dams taken over from the Ontario Government in 1905 under an Order in Council, which are maintained and operated by the Government. Of such dams there are 50 in all, 36 of them being concrete structures and the remainder timber.

Western Division (Lake Simcoe to Georgian Bay).—Under this division is included that portion of the route of the canal which lies between the navigable waters of Lakes Simcoe and Couchiching and Georgian Bay, in addition to which must also be included the now abandoned canalization of the Holland River from Cook's Bay, at the southerly end

of Lake Simcoe, to the town of Newmarket, a distance of about 12½ miles.

The original scheme for this division provided for a lock and terminals at Honey Harbor on Georgian Bay connected to Gloucester Pool via Go Home Bay and Lake. This, however, has not yet been carried into effect. The navigation of this division is now effected by means of the lock at Washago, the marine railways at Swift Rapids and Big Chute, which provide for the transportation of 15 to 20 ton boats of 13½ foot beam, with a length of 55 feet and a draft of four feet, and the lock at Port Severn.

The original design in making the Trent navigable was to establish a line of through navigation from Lake Huron to the Bay of Quinte by way of Lake Simcoe, Rice Lake and the Trent River. The route was so tortuous, however, and required so many locks, that the plan was never carried out, although a great deal of money was expended on it. In 1833 the Legislature of Upper Canada appointed commissioners to carry out the work and gave them an initial appropriation of £2,000. With this they built a small wooden lock at Bobcaygeon and improved the channel of the Otonabee River.

Surveys were made and plans drawn up for works estimated to cost £495,515, and operations were begun on a larger scale in 1837. But the financial stringency occurring at this time necessitated the abandoning of the enterprise, and when the Union was effected the whole project was placed under the Board of Works, whose chairman, H.H. Killaly, discouraged its continuance on the ground that it would cost from £800,000 to £900,000, and could not be expected to be of more than local importance. Upon his recommendation

the locks begun were finished, and slides were constructed to facilitate the descent of timber.

In the session of Parliament of 1907, it was decided to proceed with the improvement of the Trent River from the Bay of Quinte to Rice Lake by means of dams, locks and short stretches of canals. On this section the locks are 175 by 33 feet, with a depth of 8-1/3 feet. From Rice Lake to Lake Simcoe, a distance of 124 miles, six foot navigation is afforded.

The Trent Canal system is only of local importance so far as transportation is concerned. In the construction of the canals, however, dams have been built that conserve the water supply and render available a considerable amount of power which is of no small importance to the industrial development of central Ontario.

Lift bridge over new Welland Ship Canal (open)

Official photograph, Department of the Interior, Ottawa

Chapter VI—Continued

THE CANALS OF CANADA AND THE UNITED STATES

(*b*) UNITED STATES CANALS CONNECTING INTERNATIONAL BOUNDARY WATERS

THE first navigable canal to be constructed in America was, in all probability, the short stretch of waterway built in Orange County, N.Y., in 1750 by Lieut.-Governor Cadwallader Colden, for the transportation of stone.

The need for an easy means of communication whereby either persons or merchandise might be moved between the more populous eastern coast and the Great Lakes territory, had been recognized early in the period when America was being settled by white people. The course of the Mohawk River through the only break in the northern Alleghany Mountains, which was the route followed through untold ages by the Indians, was the feasible one. The steam engine had not been invented, railways had not been proposed, and waterways were the logical means of long distance transportation.

From natural to artificial waterways may seem but a step in theory; but from rivers and lakes to canals, which traverse varying lengths of country, cross swamps and climb the mountain sides, is more than a step in actual accomplishment.

In America, legislative appropriations were made for surveys and investigations into canal projects, and in 1792 two companies, the Western Inland Lock Navigation Company and the Northern Inland Lock Navigation Company, were incorporated. The first named was formed for the purpose "of

opening a lock navigation from the now navigable part of Hudson's River to be extended to Lake Ontario and to the Seneca Lake." The latter company was formed to build a canal "from the now navigable part of Hudson's River to Lake Champlain." These canals were to allow of the passage of craft 45 feet long, 20 feet wide, and with a maximum draft of two feet.

One of the first canals to be built in America was that at South Hadley Falls on the Connecticut River. This was in 1793. The lift was not by locks but by inclined planes, the boats being run into a movable caisson filled with water and hauled up by cables operated by water power. Locks were introduced later. In 1796 a canal was completed round Turner's Falls, further north in the Connecticut River at Montague.

A company called the "Proprietors of the Locks and Canals on Merrimack River," was incorporated in 1792, and they opened their canal round the falls at Lowell to the mouth of the Concord River, one and a half miles long and with four locks, in 1797. This canal was built to handle the trades of lumbering, rafts, masts and similar business.

The first general canal for passengers and merchandise to be opened in America was the Middlesex, a rival to the Merrimack Company's canal, which was commenced in 1793 and finished in 1804, at a cost of $700,000. It was 31 miles in length and ran to Charleston. The canal had a width of 24 feet, a depth of four feet, and water for navigation was obtained from the Concord River. A packet boat, the *Governor Sullivan,* plied regularly between Boston and Lowell, taking nearly a day to do the journey. The first boat voyage to Concord was made in 1814, and regular journeys by

steamer were commenced in 1819. The canal ceased to be used in 1851.

Much greater projects were, however, being set on foot about the time of these local ventures. Several of the greatest carried out afterwards were discussed even before the revolution. George Washington was deeply interested in canal schemes throughout his life, and he favored artificial channels to connect all the great American water systems. The Potomac and Ohio, the James and Ohio, and the Mohawk Valley and Great Lakes connections, were examined by him.

Pennsylvania built several small canals from 1790 to 1810, but they met with little success. In 1784 Maryland and Virginia jointly granted a charter for a canal from Georgetown on the Potomac to the Alleghany Mountains, upon which, up to 1822 when it was abandoned, a sum of about $750,000 was spent.(1)

SAULT STE. MARIE CANAL

In dealing with the canals of the United States as they exist to-day, the one that almost naturally places itself first in order of importance is the canal at Sault Ste. Marie. The movement of freight to and from Lake Superior previous to the opening of the State Canal in 1855, was by boat to Sault Ste. Marie, where the cargoes were unloaded, taken across the portage one mile long, and reloaded on other boats. In 1851 about 12,600 tons passed over the tramway portage. The shipments to Lake Superior comprised such articles as hay, oats, dry goods, groceries and mining machinery to the value of $1,000,000, and those to lower lake ports included copper, iron blooms and fish valued at $675,000.

(1) Encyclopedia Americana, Vol. V., p. 485.

Since 1855, during the 74 years the canal has been in use, the yearly traffic has increased from 14,503 to 91,888,219 net tons in 1916—the maximum record—and 86,992,997 during the past season of 1928. These tonnages include the amount passing through the Canadian Sault Ste. Marie Canal, which in 1928, totalled 2,007,880 tons.

In their original condition the channels connecting Lake Superior and Lake Huron were obstructed by rapids at the Sault, and navigation through other parts of the St. Mary's River was difficult and dangerous for boats drawing over eight feet of water. Prior to the Civil War the passage through Lake George was deepened to 12 feet by the United States Government. When the construction of the Weitzel lock was undertaken in 1870, providing for a depth of 16 feet, it became necessary to increase the channels to that depth. During the period 1882 to 1894, the Hay Lake route was improved to a depth of 20 feet.

Deepening and widening of channels has been in progress continuously for over 25 years so that a minimum depth of 21 feet is available, and the dredged areas now total 45 miles in length with a width of 300 feet. With the two-way channels round Neebish Island there is a minimum width of 600 feet or more throughout the length of St. Mary's River.

The total length of St. Mary's River is about 62 miles, approximately 48 miles from the Sault Rapids to Lake Huron, and 14 miles from the rapids to Point Iroquois, Lake Superior. The St. Mary's Rapids are about half a mile wide, and three-quarters of a mile long. The fall ranges from 17 to 21 feet, with the varying stages of water. The cities of Sault Ste. Marie, Ont., and Sault Ste. Marie, Mich., are close to the rapids and have a combined population of about 34,000.

The State Legislature of 1837 provided for a Board of Commissioners, to consist of seven members, the Governor being *ex-officio* one of the members. The board was to have care and supervision of all canals and other improvements in the State. In the same year an Act authorizing the construction of a ship canal round the Falls of St. Mary was passed, which empowered the Governor to appoint a competent engineer to proceed to the falls and make such surveys and examinations as were necessary for the construction of the canal. The engineer was required to make a report to the Governor, accompanied by maps, profiles and estimated expenses of the project. A sum of $25,000 was appropriated out of the monies of the State to be applied to the construction of the canal.

By virtue of the Act the Governor appointed John Almy as the engineer to make the surveys, which were completed in December, 1837. Mr. Almy stated in his report that to avoid great hydraulic pressure on the side walls and gates, he proposed to divide the locks into three lifts of six feet each. The canal was to be 75 feet wide and 10 feet deep and the width of the locks was to be 32 feet.

In January, 1838, the Legislature adopted a resolution calling upon Congress for a donation of land to aid in the construction of the ship canal, but without result. Governor Mason, in his message early in 1838, directed the attention of the Legislature to the report of the engineer and urged further appropriations. Early in April a supplementary Act was passed directing the commission to let the contract for the construction of the whole or part of St. Mary's Falls Canal, and appropriating a further $25,000 to carry out the work authorized. In September, 1838, the commission, on behalf

of the state, entered into a contract with Smith & Driggs of Buffalo, for the construction of the upper level of the canal. Tracy McCracken was appointed chief engineer by the board. Aaron Weeks made an agreement with Smith & Driggs whereby he obtained a half interest in the contract, and in consideration Mr. Weeks turned into the partnership a vessel named *Eliza Ward,* of 70 or 80 tons burden, completely rigged and seaworthy.

Mr. Weeks agreed to devote half his time to superintending construction and to furnish flour, pork and materials necessary to carry on the work at prime cost. Before anything was done by the contractors, the Legislature authorized an advance to them of $5,000. Shortly afterwards, Lieutenant William Root, acting assistant quartermaster at Fort Brady, informed the War Department of the intention of the state to construct a canal round the rapids of St. Mary's, and that it would interfere with the improvements made by the United States, amongst which were a millrace that was regarded as of the greatest importance.

The reply to the report of Lieutenant Root read:

> It could not, it is presumed, have been the intention of the Legislature of Michigan in contracting for the opening of the canal around the rapids of St. Mary's, authorized by that body, to interfere with the improvements made by the United States at your post, amongst which the millrace is regarded as one of the greatest importance. You will therefore apprise the contractor that he cannot be allowed, in the execution of his contract, to interfere in any way with that work.

Mr. Weeks, in October, 1838, went to Sault Ste. Marie and looked over the ground for the projected work to see what was necessary to carry it on, and early in 1839 he collected implements and men with the object of making a start. Sailing in the vessel *Eliza Ward,* he arrived in Sault Ste. Marie about the middle of May, 1839. On the following day Lieutenant

Root notified him of the orders from Washington. Thereupon, Mr. Weeks asked if the contractors would be permitted to cross the millrace with the excavation within the lines laid down by the chief engineer, and stating that they were bound to excavate the canal within those lines. The reply was to the effect that the orders from Washington were positive.

The crisis came. The contractor set about 50 men at work precisely at the place of dispute, and the Fort Brady authorities, with about 30 soldiers armed with muskets, bayonets and drawn swords, marched down upon the workmen and ordered them to stop. As they refused, the officer in command wrested a spade from the foreman and with this drove the men off the ground.

Thirteen years elapsed between this incident and the date of the canal grant in 1852. In 1840 a Bill was introduced in Congress in accordance with a memorial from the Michigan Legislature asking for an appropriation of 100,000 acres of land for the purpose of building a canal, but Henry Clay, the orator and statesman, made a speech against the measure and it was defeated.

The period of delay and failure finally came to an end in 1852 when the United States Government granted 750,000 acres of land for the construction of a canal and locks. Captain Eber Ward, a large vessel owner and an acknowledged Great Mogul of all vessel interests in the early days, protested vigorously, but in vain, against building the locks more than 260 feet long. The locks were made 350 feet long, but 260 feet would have allowed of the passage of the largest vessel he then possessed, and he did not foresee the demand for anything larger. His opposition, too, was caused by misgivings

that if a lock 350 feet long were commenced it would never be finished.

The first canal, known as the State Canal, was built between 1853 and 1855. There were two locks in tandem, each 350 feet long and 70 feet wide, having 11½ feet of water on the sills, and a lift of nine feet each. The locks were the largest in the United States up to this time, and the depth of water was the greatest that had been called for in any similar American work. The engineering features were without precedent, and the canal proved to be a success. The locks were destroyed in 1888 and replaced by the present Poe Lock.

From 1855 until 1881 tolls were charged by the state to cover operating and repair expenses. The rate was at first 6½ cents per registered ton, but this was gradually reduced to 2½ cents. The minimum charge for lockage was also reduced from $5 to $3. Tolls amounting to about $798,000 were collected, but since the control was transferred to the United States Government in 1881, the canal has been free to public use by all nations.

The Weitzel Lock was completed in 1881, and at that time it was considered as being the "last word" in lock construction. It is 515 feet long by 80 feet wide, narrowing to 60 feet at the gates. The lock is too small for most vessels passing the St. Mary's River, and it is used now in emergencies only.

The Poe Lock is 800 feet long by 100 feet wide, and when opened to commerce in 1896 was the largest lock in the world. It was designed to take in one lockage four of the largest lake vessels then in service.

Each of the Davis and Fourth Locks has a usable length of 1,350 feet, a width of 80 feet, and a depth of 24½ feet of

water on the mitre sills. They were built between the years 1907 and 1919, and are the longest in the world. In comparison with the Panama Canal locks they are 350 feet longer but 30 feet narrower. They can now take in tandem lockage two of the largest vessels in service, with about 100 feet to spare.

The importance of the Sault Ste. Marie Canal is well known. The territory bordering on Lake Superior furnishes 85 per cent of the iron ore and 10 per cent of the copper produced in the United States. In addition, the north-west produces a large portion of the grain of the country, and much of it is sent to Lake Superior ports for shipment. A large part of the north-west is likewise dependent upon vessel shipments for its coal supply, and a considerable tonnage of oil, salt and general merchandise is shipped to the head of Lake Superior.

The improvement of the Sault Ste. Marie Canal and the St. Mary's River has proved of great benefit to the whole of the United States. The ability to ship cargoes direct from Lake Superior to ports 1,200 to 1,500 miles distant, has transformed the United States and changed her position among nations. A long water haul is more cheaply effected than a long rail haul. It would be impracticable, if not impossible, to carry the freight now annually passing through the St. Mary's River and canals by rail because tracks and railway equipment are inadequate.

For purposes of comparison, it is of interest to note the achievements of some of the larger canals of the world. The Panama Canal is the greatest from the viewpoint of cost and the size of its locks. Although the traffic is increasing yearly, that for the Canadian and American Sault Ste. Marie Canals for the year 1923 was 3.16 times greater than traffic through

the Panama. The traffic through the "Soo" Canals, in 1923, was about 3.5 times greater than that passing through the Suez Canal. It must be remembered that the Panama and Suez Canals are operated twelve months in a year, whereas the "Soo" Canals are in service only about eight months. The traffic through the St. Mary's River exceeds annually that of the Panama, Suez, Kiel and Manchester Ship Canals combined.

The United States Government has expended on the improvement of the St. Mary's River a sum of about $27,000,000. This includes all locks and appurtenances and river improvements. The cost of the Panama Canal was about $375,000,000, or 14 times the St. Mary's River improvements. The cost of the Suez Canal was $140,000,000, or over five times the cost of the "Soo" Canal. Expenditure on the New York State Barge Canal was $230,000,000, on the Manchester Ship Canal $80,000,000, so that the cost of the St. Mary's River improvements is small in comparison with that of the other large waterways of the world. Yet, in amount of traffic, there is none equal to that of the St. Mary's River, and it can justly be described as the greatest waterway of the world at the present time.(1)

NEW YORK STATE BARGE CANAL

In the early days of canal construction, the magnitude of an undertaking such as a canal across New York State was sufficient to cause great diversity of opinion as to whether such a project was really possible. By many it was said to be visionary. Others took the view that such an undertaking

(1) Adapted from an article by Isaac De Young, General Superintendent of St. Mary's Falls Canal, in *The Evening News,* Sault Ste. Marie, Mich. Figures furnished by H. G. Moulton, President of the Brookings, Institution, Washington.

was a hundred years ahead of the times, and national aid was refused. Finally, however, the State of New York, by itself and unaided, undertook the construction of "Clinton's big ditch."

In the years subsequent to the incorporations of the Western Inland Lock Navigation Company and the Northern Inland Lock Navigation Company, a number of other short canals were constructed in various parts of the State of New York, and the feeling of some of the leading people in the state began to crystallize in favor of building a canal from the Hudson River to Lake Erie. A board of "commissioners for the consideration of all matters relating to said inland navigation" created by an Act of April 8, 1811, made its report in March, 1816, and by an Act in April, 1817, the building of the Erie Canal from the Mohawk River to the Seneca River, was definitely authorized.

This canal was to be 40 feet wide at the surface and 28 feet wide at the bottom, with a depth of four feet, and the locks were to be 90 feet long by 12 feet wide. Construction was begun at Rome, N.Y., in 1817. By a further enactment in 1819, the construction of the main canal was authorized between Lake Erie in the west and the Hudson River in the east. The work was expedited in the direction of both Albany and Buffalo, and the eastern end of the canal was completed by October 1, 1823.

In the latter part of 1825, as it became certain that the canal would be completed within the year, arrangements were made to celebrate in a fitting manner the finish of so great an undertaking. October 26 was fixed as the date, and a fleet of boats carrying the Governor of the State, and other import-

ant personages, left Buffalo for the through trip to New York, where they arrived in about nine days.

The first boat to travel the entire distance was the *Seneca Chief,* which carried water from Lake Erie to New York, where it was poured into the Atlantic Ocean amid impressive ceremonies to mark this "marriage of the waters." One account of the trip and ceremonies closes with these words:

> America can never forget to acknowledge that she has built the longest canal in the world in the least time, with the least experience, for the least money, and to the greatest public benefit.

The first enlargement of the canal was authorized by a law passed in May, 1835. Upon this authority the canal commissioners decided to enlarge the Erie Canal to a depth of seven feet, 70 feet wide at the surface, and with locks 110 feet long by 18 feet wide.

In 1844, the railroads which ran parallel to the canal, obtained from the Legislature the right to carry merchandise during the suspension of canal navigation, upon payment to the state of tolls at the same rate as those charged by the canal. Subsequently, the railways attempted in every possible way to evade the payment of such tolls, and it became necessary to pass a law imposing a fine for non-compliance with the statute. These tolls, however, were discontinued in 1851.

Not until April 10, 1862, was the first enlargement of the canal declared to be completed, although even at that date there still remained much to be done. By a vote of the people in 1882, an amendment to the Constitution of the State was made whereby canal tolls were abolished as from January 1, 1883. At this date the record of the Erie Canal showed:

Gross revenue	$121,461,871
Cost of maintenance ..	78,862,154
Credit balance	$ 42,599,717

This was exclusive of interest on construction and improvement costs, also of the value of the plant at that date.

Early in 1895 the so-called "Nine Million Law" was passed and approved at the election in the following November. This authorized a second enlargement of the canal, and, as regards the Erie Canal, provided for not less than nine feet of water, except over the aqueduct mitre sills and other permanent structures, where the depth was to remain at eight feet.

During all these years the history of the construction and operation of the Champlain, Oswego and Cayuga-Seneca Canals was similar to that of the Erie Canal.

Following the completion of the Erie Canal, the "commercial emporium of the United States" became New York instead of Philadelphia. The place of Philadelphia as a leading city in manufactures in the New World was also taken by New York, and with the increased advance in commerce the population grew at a rapid pace. The population of Rochester increased by 421 per cent. during the years 1820-1830, and this was the greatest gain of any town in the United States. Buffalo was second in rate of increase with 314 per cent.

In 1903, after some years of controversy, a law was passed authorizing a third enlargement of the canal. This was commonly known as the "One Hundred and One Million Dollar Barge Canal Act," for it was for the improvement of the Erie, the Oswego and the Champlain Canals. This indicates a continuance of the policy of development which had been going on for years. Applicable only to these three canals, the law provided for a channel 75 feet wide at the bottom. The locks were to be 328 feet long by 45 feet wide, with a

depth of 12 feet. The enlargement of the Cayuga-Seneca Canal was not decided upon until 1909.

In the system of canals today, all the locks are made of concrete and, except the siphon lock at Oswego which has a lift of 25 feet, all are operated by electricity. The lock at Little Falls has a lift of 40½ feet, which is greater than any lock in the Panama Canal.

As finally constructed, the New York State Barge Canal system embraces:

The Erie Canal, between Troy and Tonawanda, 342 miles long, with 34 locks, not including the Federal lock at Troy.

The Champlain Canal, between Waterford and Whitehall at the head of Lake Champlain, 60 miles long, with 11 locks.

The Oswego Canal, from Three Rivers Point north to Oswego on Lake Ontario, 24 miles long, with seven locks.

The Cayuga-Seneca Canal, from near the village of Montezuma south to Cayuga Lake, and thence to Ithaca, 42 miles long, with one lock; also, another branch from just north of Cayuga Lake west to Seneca Lake and thence to Watkins and Montour Falls, a distance of 50 miles, with three locks.

As New York State has progressed, so has its waterway system. The Barge Canal is a modernization as well as an enlargement of the former canal channels, and perhaps modernization is the more important characteristic. While wooden barges are still in great number, the modern Diesel electric self-propelled cargo carrier has proved its worth, and Diesel-engined tow boats are rapidly displacing the coal burning tow boats of nine or ten years ago.

The advantages of the waterway to the community may be summarized as follows:

(1) A direct saving over railroad rates in freight charges, which is estimated to average $1 per net ton, or $2,581,892 for the year 1927;

(2) The estimated saving of $50,000,000 per annum on tonnage moved by rail on a lower rate scale than would be applied if canal competition had not existed in the past, and did not still exist. This amount, although an estimate is entitled to credence by reason of its repeated assertion by traffic students, and its acceptance by such investigating bodies as the Barge Canal Survey Commission;

(3) The commercial supremacy of the Empire State is admittedly due in large measure to the original Erie Canal. Enlargements have helped to maintain fully 70 per cent. of the state's population within two miles of the waterway system.

Navigation on the New York State Barge Canal system is free, and the Constitution of the State provides that its canals may not be sold, leased, or otherwise disposed of, but must remain state property and under its management for ever. The canal channel is indicated, where any considerable width of water exists, by a complete system of buoys, lighthouses, range towers, lights and beacons, so that night and day operation of vessels is practicable.

In 1847 there were reported to be 4,191 boats in canal service, with a combined total cargo capacity of 279,260 tons, or an average of about 66-2/3 tons per vessel. In 1927, there were 770 cargo vessels in service, with a known cargo capacity of 416,860 tons, or over 541 tons per boat; and the latest type of motorship has a capacity of 2,000 tons on canal draft.

In 1909 the Barge Canal Terminal Commission was created to study the question of terminals and other facilities for the state canals. In 1911, the state, by referendum vote, approved an appropriation of $19,800,000 for the construction of terminals, mainly in accordance with the suggestions made in the commission's final report.

Tonnage through the canals, although not up to the hopes of their most ardent advocates, has shown an almost continu-

ous yearly increase since the opening of the Barge Canal to through traffic in 1918. For that year's season of navigation the tonnage was 1,159,270 net. For the season of 1927, the figure was 2,581,892 tons, an increase of 122 per cent.(1)

The Sault Ste. Marie Canal and the New York State Barge Canal system are the most important artificial waterways connecting international boundary waters. Lesser, though still important canals in this class, all of which have a bearing on the St. Lawrence Waterway project, are as follows:

(1) *Sturgeon Bay and Lake Michigan Ship Canal*

This is a revetted canal connecting Lake Michigan and Sturgeon Bay, a basin having an area of about 12 acres, enclosed by breakwaters at the Lake Michigan end, and a dredged channel connecting the west end with deep water in Sturgeon Bay. The canal is on the west shore of Lake Michigan about 47 miles north-east of Green Bay City, and about 128 miles north of Milwaukee.

In its natural condition Lake Michigan was separated from Sturgeon Bay by a neck of land about a mile and a half wide. The canal and channel in Sturgeon Bay were originally constructed by a private corporation. It then had a width of 100 feet at the surface, and a depth of about 12 feet, with the same depth in the channel.

In 1903 the United States Government took over the canal and enlarged it by providing an outer harbor protected by two converging breakwaters, each 1,344 feet in length, extending from the shore on either side of the east or Lake Michigan end of the canal; for a channel extending from deep water in the lake to the canal entrance at the shore line, a total length of 1,300 feet, varying in width from 600 feet at the outer

(1) From information supplied by Thomas F. Farrell, Commissioner of Canals and Waterways, New York State.

end in the lake to 160 feet at the canal entrance; for a revetted canal, 7,200 feet in length, varying in width from 160 to 250 feet, and for a channel through Sturgeon Bay from the west end of the canal to deep water in the bay, a distance of four miles, having a width of 200 feet; all channels being 19 feet deep at low water. This was completed in 1919.

As the canal and its connecting channels are a through waterway there are no terminal facilities. The nearest port is the city of Sturgeon Bay, four miles from the west end of the canal. The main object of the waterway is to shorten the distance from ports on the west shore of Lake Michigan to Menominee harbor by about 50 miles, and to Green Bay harbor by about 70 miles. Practically all car ferry traffic between Frankfort and Menominee now moves by the canal.(1)

(2) *St. Clair Flats Canal*

This canal is situated at the outlet of the south channel of the St. Clair River delta, which affords the shortest route for through navigation. The construction work originally consisted in dredging separate channels for upbound and downbound traffic through the shoals at the outlet of the south channel and extending into Lake St. Clair, protected in parts by dykes.

These two channels extend from deep water in the south channel to deep water in Lake St. Clair, a distance of about 17,460 feet. For a distance of 7,221 feet at the upper end the channels are separated by a sand dyke 100 feet wide, revetted by sheet piling, and for the same distance the east channel is enclosed on its east side by a rubble mound from 20 to 25 feet wide at the top, and having riprapped slopes.

(1) *Annual Report of the Chief of Engineers, U.S. Army, 1928,* p. 1352-1354.

The east, or upbound channel, has an available width of about 294 feet between the dykes, and the west, or downbound channel, is 300 feet wide. Below the dykes the two channels are combined, starting with a width of 700 feet and gradually widening to 800 feet, in a length of 10,000 feet. The channels are subject to shoaling both above and below the separating dyke, and to filling-in along the unprotected sides. Dredging in recent years has maintained the channels to the full depth of 20 feet, extending to a distance of two miles below the canal. Shoaling below the separating dyke frequently recurs.

The old channel at its outer end is about a mile and a half north-west of the present canal, and its upper end connects with the south channel just above the dykes. From Lake St. Clair to its connection with the main channel, it has a length of about two and a half miles, with a depth over a narrow and irregular width of not more than 11 feet. It provides a passage for small vessels, yachts, and other craft of light draft, which can thus avoid passing through the canal channels used by the larger carriers.

The ship channel dredged through the shoal at the foot of Lake St. Clair, and leading to deep water at the head of the Detroit River, is a straight cut 30,000 feet long, 800 feet wide, and 21 feet deep. It is known as the Grosse Pointe Channel. and is subject to shoaling along the sides. A survey made in 1926 showed a depth of 21 feet for a width of nearly 800 feet. Depths adjacent to the channel vary from 12 to 15 feet.([1])

(1) *War Department, Corps of Engineers, Bulletin No. 38, April, 1929,* p. 298, 299.

(3) *Black Rock Channel*

This waterway provides a safe passage for large vessels round the rapids and shoals in the head of Niagara River. The Lake Erie entrance consists of a channel from Buffalo harbor to the north entrance of Erie Basin, and thence northwesterly about 2,400 feet to the head of Black Rock Canal at the foot of Maryland Street, Buffalo. It has been dredged to a depth of 20 to 21 feet, and its width varies from 400 to 1,000 feet.

The Black Rock Canal lies along the Niagara River front of Buffalo, generally parallel with the river and separated from it by Bird Island Pier and Squaw Island, which retain the canal pool to the west end which, with the Black Rock Lock, serve to keep the canal level at the same elevation as the water surface of Lake Erie. From its head the canal extends a distance of three and a quarter miles to the lock near the lower end of Squaw Island. It has been dredged to a depth of 21 feet and a width of 200 feet, increased to 240 feet at curves.

Black Rock Lock, which connects the canal with the river near the foot of Squaw Island, is 650 feet long between quoin posts (usable length 625 feet), 70 feet wide (68 feet in the clear), with a depth of 22 feet of water over mitre sills, and an average lift of over five feet. It is operated and lighted by electricity.

Since the completion of the ship channel in August, 1914, the waterway is used by the largest lake vessels and by canal boats, barges, tugs and motorboats to avoid the swift currents in Niagara River.(1)

(1) *War Department, Corps of Engineers, Bulletin No. 38, April, 1929,* p. 377, 378.

(4) *Keweenaw Waterway*

This is a navigable channel with a minimum width of 120 feet. It is 25 miles long, and runs across Keweenaw Point, Mich., with its upper or western entrance 166 miles east of Duluth, and its lower or eastern entrance 205 miles west of Sault Ste. Marie. The entrances are protected by breakwaters, and harbors of refuge with mooring piers are built at both entrances. At the time of the purchase of the waterway by the United States Government, August 3, 1891, the channel was narrow and crooked, with many sharp bends. It was badly marked and lighted, and the entrance piers were in an unsatisfactory condition. The revetments were decayed or entirely gone. The width of the channel in use was 70 feet, and the usable low water depth was 12½ feet.

The present canal is a navigable channel 25 miles long, 20 feet deep, with a minimum bottom width of 120 feet. It has pile and timber revetments, and a stone filled timber crib pier 3,714 feet long at the lower entrance extending to 20 foot depth of water. Converging stone filled timber crib breakwaters are at the upper entrance, the westerly breakwater being 2,745 feet long, and the easterly one 2,485 feet long. There is an upper entrance anchorage basin, 3,600 feet long by 600 feet wide, with 5,924 feet of timber mooring posts. The lower anchorage basin is half a mile long and 800 feet wide, with a timber mooring pier 2,000 feet long. A curved cut-off channel has been made at Princess Point, which is 200 feet wide and 20 feet deep, and about three-quarters of a mile long.

Navigation on Lake Superior has been rendered safer by this waterway inasmuch as vessels use it during stormy weather instead of rounding Keweenaw Point. Commercial facilities in connection with railways are better served in this

important copper mining district by the use of larger vessels for the transportation of freight, which was not possible before the enlargement of the waterway. The effect on freight rates has been to reduce them materially.(1)

The canals of the United States which have little or no bearing on the subject of the St. Lawrence Waterway project do not come within the scope of this book, but readers who desire to study the complete system of American canals are referred to the Bibliography where a number of sources of information are given.

The projects of the Georgian Bay Canal, the "All-American" Ship Canal, and the Lakes-to-the-Gulf Deep-Waterway, which latter includes the Illinois and Michigan, and the Illinois and Mississippi Canals, are dealt with fully in Chapter VIII.

(1) *Annual Report, Chief of Engineers, U.S. Army, 1928,* p. 1309-1311.

Chapter VII

THE CHICAGO SANITARY AND SHIP CANAL

(CHICAGO DIVERSION)

Jus publicum privatorum pactis mutari non potest.
(A public right cannot be changed by a private agreement)

Chapter VII [1]

THE Chicago Sanitary and Ship Canal, built at a cost of $75,000,000, primarily to stop the pollution of Lake Michigan and to dispose of the sewage of Chicago, is also part of the Lakes-to-the-Gulf-Deep-Waterway, connecting Lake Michigan with the Mississippi River.

This is made clear in an article, "Division of Waterways," by William F. Mulvihill, Supervisor of Illinois Waterway Construction, in which he says: "Navigation through the Illinois Waterway requires the diversion of a certain amount of water from Lake Michigan. The continental divide separating the Great Lakes-St. Lawrence basin from the Mississippi watershed lies but a few miles west of the city of Chicago. By digging a drainage canal through this elevation the current in the Chicago River was reversed, and it became in fact and in law a part of the Mississippi River system." The Chicago River used to run into Lake Michigan, but its waters have been turned back to give Chicago an outlet for sewage; make possible her nine foot waterway to the Mississippi, and create a substantial water power.

(1) The following are the principal sources of the information contained in this Chapter:

The Most Gigantic Engineering Blunder in America, Address by William G. Bruce, etc. *Construction Work by Governor Len Small*, etc. *The Chicago Drainage Canal. Precis of Documents and Proceedings Prepared for the use of the Senate in accordance with the request of Hon. W. B. Ross. Supreme Court of the United States, Nos. 7, 11, and 12 Original.—October Term, 1928.* Newspaper and magazine articles of the period.

Two hundred feet wide, and 19 to 26 feet deep, the river leaves Lake Michigan at the harbor of Chicago, joins the Sanitary and Ship Canal six miles further on. The Sanitary Canal itself is 35 miles long, 160 feet wide, and has a minimum depth of 21 feet. The next section of the waterway consists of the Illinois and Michigan Canal, 64 miles long, connecting with the Illinois River below the town of La Salle, 233 miles from the Mississippi. These rivers and canals cross the state of Illinois from Lake Michigan to the Mississippi, a distance of 325 miles, the whole forming a section of the Lakes-to-the-Gulf-Deep-Waterway from Chicago to New Orleans by way of the Mississippi River. It is expected to be open for navigation in the spring of 1931.

This development is only possible by diverting the waters of Lake Michigan. How valuable this diversion is deemed to be by Chicago may be gathered from the prediction that within ten years the commerce of the Lakes-to-the-Gulf-Deep-Waterway will be greater than the tonnage of either the Suez or Panama Canals. It is also stated that the completion of the Illinois waterway will add $100,000,000 a year to the volume of Chicago's business.

Everybody has had his attention drawn to the illegal diversion of water from Lake Michigan for the purpose of sewage disposal. Very few have realized the magnitude of this gigantic undertaking, its international significance, or its bearing on Great Lakes and St. Lawrence navigation. The idea of using the waters of Lake Michigan for sewage disposal first occurred in 1889, when Chicago decided to construct a drainage canal 33 miles long, with a varying width of from 162 to 300 feet, and a uniform depth of 24 feet. The drainage canal was constructed under an Act of the

State Legislature of Illinois, dated May 29, 1899, and was designed to carry out of Lake Michigan 14,000 cubic feet of water per second.

The channel was to be of a size sufficient to dispose of the sewage and drainage of Chicago as the increase of the population might require, with a capacity to maintain an ultimate flow of *not less* than 600,000 cubic feet of water per minute, and a continued flow of *not less* than 20,000 cubic feet for each 100,000 of population within the Sanitary District. In addition, it was to improve canal navigation between Lake Michigan and the Mississippi River, and provide a source of water power for Chicago. Some idea of the extent of the Chicago Sanitary District which this drainage system was to serve, may be gathered from a knowledge of what the District comprises. It has an area of 437 square miles, and contains 49 towns and villages outside of Chicago, with a total population in 1923 of 3,213,000.

The last official report of the Chicago Sanitary District, however, estimates the total population for sewage purposes by merging the industrial wastes of the stockyards, and the corn products company, with the living population, and calling it 4,800,000—so many cubic yards of offal being equal to so many citizens! As previously noted, under the State Act of Incorporation, the drainage canal was required to provide a continuous flow of not less than 20,000 cubic feet per minute for each 100,000 of population. By including in this estimate all the industrial wastes of the stockyards and other industries, Chicago established enormous population figures as a justification for taking a tremendous quantity of water per minute from Lake Michigan.

From Chicago's point of view this was a simple method of enhancing the value of the city's water power development and the waterway to the Mississippi. The annual profit from power alone is said now to have reached $1,000,000 or more.

In order to understand how this gigantic diversion came about it is necessary to go back to the beginning. On May 8, 1899, United States Secretary of War, Russell A. Alger, issued a permit to the Sanitary District of Chicago to take 5,000 cubic feet of water per second from Lake Michigan into the drainage canal. In April, 1901, Secretary of War, Elihu Root, issued an order to have this reduced to 4,167 cubic feet per second, but the amount of water withdrawn during the years that followed was approximately 10,000 cubic feet per second, and sometimes considerably more.

The obvious deduction from all this is that the part is greater than the whole; that the authority of an individual state is greater and more powerful than the authority of all the United States. To legalise the withdrawal of excess water over and above the limit fixed by the Federal power, Chicago made many appeals to Washington without result. Five Secretaries of War declined to grant the necessary permission, viz., Messrs. Taft, Stimson, Garrison, Baker, and Weeks. Notwithstanding this, the Chicago Sanitary District has gone on just the same taking the water she wanted in defiance of Washington.

It is well to remember that the original permit granted by the War Department in 1899 was both temporary and conditional—subject on the one hand to the approval of Congress, but to be abrogated if found to be against the public interest. As a matter of fact, Congress never approved it nor cancelled it. In 1906, Washington took out an injunction in the Federal

Court of Chicago to restrain the Sanitary District from diverting more than the legal limit of water fixed under the permit.

Six years passed before any arguments were presented. In 1913, notwithstanding legal proceedings in process, Chicago appealed to Washington for a further increased flow, which was refused. The Federal Water Department thereupon notified the Chicago Sanitary District that it was drawing more water than was allowed and was violating section 10 of the Act of March 3, 1899. Chicago replied that, bound by the state law, and in obedience to it, the District had been flowing 20,000 cubic feet per minute for each 100,000 of population (including the stockyard wastes classified as living beings) and could not reduce the flow. It took eleven years more to reach the first Court decision, in 1923, which was against the Chicago Sanitary District. Up to then seventeen years had passed since the legal battle started between the Federal power and the individual state.

On June 19, 1920, Judge Landis rendered an oral opinion, finding in effect that the withdrawal in excess of 4,167 cubic feet per second by the Sanitary District of Chicago was without authority of law; that the withdrawal then made reduced the level of Lake Michigan, and other of the navigable waters of the United States, to such an extent as to be an interference with navigation; that the Secretary of War, acting within his powers, had never given consent to such excessive withdrawals; that the diversion by the Sanitary District was, therefore, unlawful, and that an injunction should be issued.

Three years later, in 1923, in the United States District Court at Chicago, Judge Carpenter cited the oral opinion of Judge Landis, and added:

> The evidence shows, and Judge Landis found, and I find, that the waters of Lake Michigan and other navigable waters of the Great Lakes, have been reduced in level by the water in excess of 4,167 cubic feet per second withdrawn from Lake Michigan by the defendant.

Thereupon the whole matter was sent to Appeal in the United States Supreme Court where, on January 5, 1925, a decision was rendered against the Sanitary District. In this decision from the most august judicial body, the highest Court in the United States, the pronouncement was made that any abstraction of waters from the Great Lakes "affecting the natural level or flow of boundary waters, is especially provided against by the international treaty with Great Britain of January, 1909, without the consent of Canada or the United States, within their jurisdiction." It was obviously impossible to cut off all at once the disposal of sewage through the canal and, conditional on an immediate scheme of sewage disposal and other remedial works by the city of Chicago, which are now being carried out, a temporary permit was issued granting the right to divert 8,500 cubic feet per second.

Notwithstanding a legal battle between the two for twenty-three years, with the decisions always against the Sanitary District, the law of the individual state had held at bay the law of the Federal power. The judgment of the Supreme Court changed all this.

Among other things the Supreme Court of the United States pointed out in its judgment that the sovereign power of the United States to remove obstructions to commerce was superior to that of an individual state in acting for the welfare or necessities of its inhabitants, and it ordered the Sanitary District to provide by 1929 sewage works sufficient for a population of 1,200,000. The Sanitary District was to install meters to reduce the waste of water for domestic use without

unreasonable interference with navigation. It was to construct control works; to deposit a bond as a guarantee of the payment of the cost of regulating or compensating works to restore the lake levels. The permit was to be revocable at will and without notice if the sewage works or the metering programme were not carried out.

Charles Evans Hughes, Master in Chancery for the Supreme Court, reported in October, 1927:

> That the diversion lowered the waters of Lakes Michigan and Huron by approximately six inches, and Lakes Erie and Ontario by approximately five inches;
>
> That substantial damage was caused to the navigation, commercial and other interests of the complainant states, by that portion of the fall attributable to the Chicago diversion;
>
> That the diversion was an aid to navigation in the Illinois and Mississippi Rivers;
>
> That the Joint Engineering Board had shown that the levels could be restored at reasonable cost by compensating works and dredging;
>
> That the State of Illinois and the Sanitary District of Chicago have no authority to make or continue the diversion in question without the consent of the United States;
>
> That Congress has power to regulate the diversion;
>
> That the permit of March 3, 1925, is valid and effective according to its terms, the entire control of the diversion remaining with Congress.

Canada had all along been taking steps to protect her rights and interests. In March, 1912, the Canadian Government sent four representatives to Washington to oppose any proposal which would result in lowering the level of international boundary waters. In February, 1913, a formal and substantial protest was forwarded through the British Ambassador. No protests were made during the war, but they were renewed in 1921, December, 1923, and February, 1924. These protests by Canada had the effect of causing to be included in

the terms of reference to the Joint Engineering Board appointed to report on the St. Lawrence Waterway project, instructions to consider the effect on lake levels of diversions from the St. Lawrence watershed, and possible means of restoring the levels.

The diversion by the Chicago Sanitary District of 8,500 cubic feet per second from the lake basin through the Chicago Drainage Canal, authorized by license of the United States Government, lowers the water levels of the Great Lakes and St. Lawrence River as follows:

	Level Lowered by:
Lakes Michigan and Huron	0.5 foot
Lake Erie	0.4 "
Lake Ontario	0.4 "
St. Lawrence River between Lake Ontario and Montreal:—	
At Prescott	0.4 "
At Lock 25 (Iroquois)	0.6 "
At Lock 23 (Morrisburg)	0.5 "
At Lock 21 (Dickinson Landing)	0.4 "
At Lock 15 (Cornwall)	0.3 "
Lake St. Francis	0.2 "
Lake St. Louis	0.3 "
St. Lawrence River at and below Montreal:—	
At Montreal Harbor	0.37 "
At Varennes	0.35 "
At Sorel	0.38 "
At Batiscan	0.24 "
At Lotbinière	0.24 "
At Platon	0.17 "
At Quebec	0.03 "

The effect of diversion on the levels of Lake Ontario and the St. Lawrence River above Montreal would be removed by the works for the improvement of this section, while the effects at and below Montreal could be restored by dredging and accessory works costing $4,608,000.

Following the decision of the Supreme Court in 1925, and the issue of the new permit, the Canadian Government elicited the information that the 8,500 cubic feet per second, which the Chicago Sanitary District was authorized by permit to draw, might be reduced to 8,000 or possibly 6,700 feet by 1930. It also elicited the information that the sewage treatment project by the Sanitary District had been arranged to make possible a reduction to 4,167 cubic feet per second by 1935 or earlier.

In 1928, during the discussion of the St. Lawrence Waterway project, the Canadian Government expressed the view that in case of further consideration of this project by the two countries, opportunity should be sought for reaching a comprehensive settlement of all outstanding problems affecting the Great Lakes and St. Lawrence River, including the preservation of the waters properly belonging to the St. Lawrence watershed. The United States Government replied that it would be glad to have the discussion extended to any outstanding problems affecting the lakes and river as suggested by Canada.

It is important that the public should know exactly what the Chicago Sanitary District has done to carry out the judgment of the Supreme Court. Up to December 31, 1928 it has expended on completed relief works for sewage treatment a sum of $63,355,422, and has works under contract to be completed, the estimated cost of which totals $30,035,863. By December, 1929, the permit granted to the Sanitary District by the Federal Government of the United States expires. The Sanitary District will then have expended in the erection of plants for the disposal of sewage the sum of $93,391,285.

Sault Ste. Marie locks from the air, showing American locks (left) and Canadian lock (right), between Lake Superior and Lake Huron

Official photograph, Royal Canadian Air Force

Notwithstanding this expenditure for remedial works to correct the illegal diversion of Lake Michigan water in excess of the original 4,167 cubic feet, the following lake states, Wisconsin, Minnesota, Ohio, Pennsylvania, Michigan and New York, through their Attorneys-General, signed a memorial to President Hoover not to approve of any plan for the development of the Lakes-to-the-Gulf-Deep-Waterway that would contravene the decision of the Supreme Court of the United States in the Chicago Sanitary District case.

This memorial points out that the diversion of water from the Great Lakes in excess of 1,000 cubic feet per second would impose "a wholly unnecessary burden upon lake-borne commerce in that such excess is not required to permit the utilization of a nine foot channel from Lake Michigan to the Mississippi River."

The following is an official summary of the memorial:

In spite of the obvious limits upon the power of the Federal Government to authorize abstraction of water from the Great Lakes for the need of navigation, the Sanitary District of Chicago has conceived a plan for improving the Illinois River as a waterway which will cause much larger continuous diversions than are necessary for navigation purposes, the plan of said Sanitary District being to continue to pollute the Chicago River and thus to require diversions larger than are needed for navigation in order to purify or immunize the pollution which the Sanitary District intends to continue to create.

The records of the litigated cases plainly show that one inducing reason for this plan and intention of the Sanitary District is the large profit derived by the Sanitary District for the use of water diverted from the Great Lakes for power purposes at the expense of a much larger power development by the use of the same water at the eastern end of the lakes after all the purposes of navigation have been served and which does not involve any diversion from the watershed.

Any consideration of the problem presented must thus take account of the improper uses which have been made by the Sanitary

District of this diverted water for sewage purposes and power purposes and every plan which is presented for the development of lakes to gulf navigation must be considered with the knowledge that the interests of the Sanitary District are not primarily navigation interests. In the records of these litigations it is shown that the waterway proposed to be constructed by the State of Illinois is expected to yield to the State an annual $2,000,000 profit from water power while the Sanitary District of Chicago at the same time is to make an annual $1,000,000 profit from this use of diverted water for power purposes.

Each diversion of water from the Great Lakes system is at the expense of the level of those lakes. The Great Lakes of cargo carrying steamships and all the ports, vessels and machinery for the vast commerce of the Great Lakes are adapted to their most economical use with high lake levels. Any diversion in excess of 1,000 cubic second feet imposes a wholly unnecessary burden upon lake-borne commerce in that such excess is not required to permit the utilization of a nine-foot channel from Lake Michigan to the Mississippi river.

There is, too, involved in this whole matter a precedent of fundamental national importance. If the Sanitary District or the State of Illinois can be authorized to divert water into the Mississippi watershed, a precedent is established for other and increasing diversions with peril to Great Lakes navigation which now can only be dimly foreseen.

The Dominion of Canada shares with the United States access to, and use of the Great Lakes waterway. The interest of that Dominion is in interest with that of the complaining States. In any such improvement, if diversion be authorized at all, navigation should be the object sought. So far as the improvement of the Illinois River is concerned, the War Department has prepared several plans somewhat varying in their initial cost. They require for their successful operation different amounts of diversion from the Great Lakes. The most costly of such proposed plans is an insignificant burden when compared with the economic value to the country of the diminished diversion required by it.

The attorneys general of the respective complaining States, feel it their duty to bring these matters to your attention, in order that the inquiry which you have directed to be made, may be considered with the view to the preservation of the rights of the peoples of the several States, to whom the preservation unimpaired of the Great Lakes waterway is a matter of supreme economic importance.

Chapter VIII

ALTERNATIVE WATER ROUTES TO EUROPE

Agriculture, manufactures, commerce are the springs of national wealth.—Chaptal.

Chapter VIII

WHAT are the water routes available, or shortly to become available, for the trade and commerce of the North American continent and Europe alternative to the St. Lawrence route? This question is answered almost by a glance at the map facing page 326.

HUDSON BAY ROUTE

This, the most northerly of the alternative water routes to Europe, is expected to be in operation during the summer of 1930. In Winnipeg, Regina and other western cities, the advantages of the Hudson Bay route have received much attention. It has been argued that Hudson Bay is the natural outlet for the exports of western Canada; that the waterway has been used for over 200 years by the Hudson's Bay Company, and that all that remained to be done to make the route available was for the Canadian Government to complete a railway to the coast.

The distance from Winnipeg to Liverpool via Fort William and the St. Lawrence route is 4,425 miles, whereas the distance from Winnipeg to Churchill, 992 miles, and thence to Liverpool by the Hudson Bay route, is 3,938 miles. Thus, there is a difference of 487 miles in favor of the latter route insofar as actual mileage is concerned. The farmers of western Canada expect, in consequence, a proportionate lowering of transportation charges on wheat.

The resident engineer of the railway places the season of navigation from August 20 to October 20, but the success of the new route will be determined by experience.

The total expenditure by the Department of Railways and Canals in connection with the construction of the railway since 1911-1912 to the end of December, 1928, amounted to $23,817,455, according to a return made in the House of Commons on February 12, 1929. On the port of Nelson, which was the original terminus chosen, the Department spent $6,274,217, and on Churchill $3,541,185 has been disbursed.(1) When the line to Churchill has been completed it is estimated that the total cost of the railway will have amounted to about $28,500,000, exclusive of terminals.(2)

The area of Hudson Bay, including James Bay, is 576,000 square miles, or more than the total area of Manitoba and Saskatchewan. This great body of water measures nearly 1,000 miles from north to south, and 600 miles from east to west at its greatest breadth. Hudson Strait, the sea passage to the Bay, is itself 500 miles long, with an average width of over 100 miles.(3)

Fort Churchill, the ocean port, is an old settlement at the entrance to Churchill harbor, on the west shore of Hudson Bay, set up about 1715 as a trading port by the Hudson's Bay Company. It has always been regarded as the key to the Canadian west and the interior.(4)

ERIE CANAL ROUTE

This waterway has been described in detail in Chapter VI, (b) United States Canals Connecting International Boundary Waters.

(1) *The Gazette,* Montreal, February 13, 1929.
(2) *The Montreal Daily Star,* January 23, 1929.
(3) *The Montreal Daily Star,* March 21, 1929.
(4) *The Montreal Daily Star,* April 12, 1929.

As an alternative Atlantic route to the St. Lawrence, freight loaded at Buffalo would proceed via the Niagara River north to Tonawanda, thence through the Erie Canal to Three Rivers Point to Troy, thence through the Hudson River to New York. The total distance from Buffalo to New York is 506 miles.

Lake Ontario, also, is in direct connection with New York, as at Three Rivers Point on the Erie Canal there is a connection with the canalized Oswego River which can be entered and followed for 24 miles to Oswego on Lake Ontario. The distance from New York to Oswego is 338 miles.

The dimensions of the improved Erie and Oswego Canals, as far as depth of channel and size of lock chambers are concerned, are uniform. A depth of 12 feet has been provided. Through canalized rivers and lakes the channel is at least 200 feet wide. Through rock cuts a minimum bottom of 94 feet has been made, and through earth sections, 75 feet. The dimensions of the locks on all improved canals have been made identical so far as is practicable. The length of the lock chamber from the lower gate to the breast wall is 310 feet which, considering the operation of the gates, will permit the locking of a barge 300 feet in length. The width of the lock chambers has been planned at 45 feet.(1)

LAKES-TO-THE-GULF-DEEP-WATERWAY

The route of this waterway is from Lake Michigan to the Mississippi River and the Gulf of Mexico via the Chicago River, the Chicago Sanitary District Drainage Canal, the Illinois and Michigan Canal, and the Illinois River.

(1) *New York State Canal System,* by F. S. Greene and T. F. Farrell, p. 5-14.

Vessels navigating these canals leave Lake Michigan at the mouth of the Chicago River. The minimum width of the canal is 200 feet, except for one short stretch, and the depth of water varies from 19 to 26 feet. Six miles from the mouth, vessels enter the Chicago Sanitary District Canal which, from Chicago to the Lockport Lock, is a distance of 30 miles. This channel has a minimum width of 160 feet narrowing to 97 feet at bridges, with a minimum depth of 22 feet.

From the Lockport Lock to the Illinois and Michigan Canal at Joliet, a distance of two and a half miles, the Desplaines River has been improved by the Sanitary District of Chicago, and has a minimum depth of nine feet. The Lockport Lock has a width of 22 feet, a usable length of 130 feet, and a maximum lift of 40 feet. The State of Illinois is now building a lock 110 feet wide, 600 feet long, with a maximum lift of 43 feet.

The portion of the Illinois and Michigan Canal between Joliet and LaSalle, now in use, is about 64 miles long, it has 11 locks with lifts varying between four and 13½ feet, and is available for craft not exceeding three and a half feet draft. The locks and fixed bridges limit the size of boats to the following maximum dimensions: Length, 98 to 102 feet according to type; beam, 16 feet at the water line and 14½ at four and a half feet depth; draft, four and a half feet over the lock sills.

From the end of the Illinois and Michigan Canal where it joins the Illinois River below LaSalle, to the junction of the Illinois and Mississippi Rivers near Grafton, 40 miles above St. Louis, is a distance of about 223 miles. The locks are 350 feet long and 75 feet wide, with a minimum depth of seven feet.

An alternative route to the foregoing is that via the Illinois and Mississippi Canal. This canal was constructed by the United States Government; it is 75 miles long from its starting point on the Illinois River 14 miles below LaSalle, to its junction with the Mississippi River at Rock Island. The canal feeder, from Rock River at Sterling, to its junction with the canal, is 29 miles long. Normal dimensions of the canal and feeder are: 80 feet wide at the water surface, with a depth of seven feet. There are 34 locks with lifts from six to 12 feet, including a lock giving access to the town of Sterling. Each lock is 35 feet wide with a usable length of 143 feet, and a depth of seven feet.

Upon the completion of the work now being performed by the United States Government and the State of Illinois, the minimum depth of the Lakes-to-the-Gulf-Deep-Waterway will be nine feet. By it the distance from Chicago to New Orleans, where it flows into the Gulf of Mexico, is 1,519 miles. It is expected that the work will be completed late in 1931.([1])

VANCOUVER-PANAMA ROUTE

Owing to the shorter rail haul involved, this route offers advantages for commerce from the Provinces of Alberta and British Columbia and the State of Montana, U.S.A. During the sittings of the International Joint Commission it was stated that the objection that grain would heat during the passage through tropical waters was not well founded when suitable precautions were taken.([2]) The distance from Vancouver to Liverpool is 8,647 miles.

(1) *Illinois Waterways,* Fifth Edition, also from information supplied by W. F. Mulvihill, Supervisor Illinois Waterway Construction.

(2) *Report of the International Joint Commission,* p. 95.

The St. Lawrence and Alternative Water Routes to Europe

	TO		STATUTE MILES
CHURCHILL	LIVERPOOL	2926	"
MONTREAL	"	2760	"
QUEBEC	"	2625	"
HALIFAX	"	2485	"
SAINT JOHN	"	2747	"
PORTLAND (MAINE)	"	3480	"
BOSTON	"	3521	"
NEW YORK	"	3073	"
NEW ORLEANS	"	4613	"
VANCOUVER (VIA PANAMA)	"	9930	"

GEORGIAN BAY CANAL PROJECT

Whatever may be the outcome of the plans, surveys, commissions and diplomatic negotiations regarding the St. Lawrence Waterway project, the fact remains that both Canada and the United States have alternative projects for the construction of great national waterways for the improvement of navigation from the interior of the continent to the Atlantic Ocean.

The Canadian project, or the Georgian Bay Canal, is for an improved waterway between the St. Lawrence River and Georgian Bay by way of the Ottawa River, Lake Nipissing and French River. It dates back to the year 1837, when a report on the possibilities of the Georgian Bay route for canal construction was made by John McNaughton and Charles P. Treadwell.

The route itself had been the main highway of the fur trade from the days of Champlain but, because of its many portages, it was practicable only for canoes. In 1858 Walter Shanley made a report on the proposed canal. He estimated the cost of construction of a 10 foot waterway at $24,600,000, his plan being, in general terms, to cut canals at all points not already navigable in preference to the canalization and regulation of the river. Mr. Shanley met the problem of the summit level by suggesting that the level of Lake Nipissing should be raised until it became the summit level.

T. C. Clark, who continued Mr. Shanley's work and reported in 1860, estimated the cost of a 12 foot waterway at $12,057,680, the decrease in the estimate being due mainly to the adoption of considerably lower unit prices for the necessary excavation. Mr. Clark favored where possible the use of canalized river in preference to wholly artificial channels.

Although the feasibility of the project as an engineering problem had been established, there was much difference of opinion as to its value from a commercial point of view, and the plan was laid aside for some years.

About 1890 agitation in favor of the project recommenced and T. C. Clark was again called upon to report. In 1898 he recommended the adoption of a barge canal with a depth of 14 feet on the lock sills. The idea of raising the level of Lake Nipissing as a solution of the summit level problem was now abandoned on account of the growth of settlement round the shores of the lake, and Mr. Clark proposed instead to lower the small summit lakes, Trout and Turtle Lakes, to the level of Lake Nipissing.

The project again lapsed for a time and was once more revived in 1904, when the Canadian Government authorized a complete survey. An interim report was laid before Parliament in 1908, and a final report in the following year. The Government Engineering Board, which had the matter in hand, reported that a 22 foot waterway for the largest lake boats, 600 by 60 feet with 20 feet draft, could be built in 10 years at a cost of $100,000,000, and that the annual maintenance would be approximately $900,000, including the operation of storage reservoirs for the better distribution of the flood waters of the Ottawa River. These storage reservoirs were subsequently built, although the project as a whole never received Government approval.

It may be noted that the distance from Montreal harbor to French River village on Georgian Bay is 440 miles. The rise from the harbor of Montreal to the summit of 659 feet can be overcome by 23 locks, ranging from five to 50 feet in lift, and the descent of 98 feet from the summit to Georgian

Bay can be made by four locks, ranging from 21 to 29 feet in height of lift; or altogether 27 locks, connecting 23 navigable pool levels of various lengths.

During the sittings of the International Joint Commission at North Bay and at Montreal, some views were expressed on the Georgian Bay scheme, and its advantages as a water route from the Great Lakes to the sea. The Montreal Chamber of Commerce preferred the canal to the St. Lawrence Waterway project because it was a purely Canadian route and, therefore, of more benefit to Canada. E. L. Cousins of the Toronto Harbor Commission stated, on the other hand, that the Georgian Bay route had been investigated, and it had been established that a vessel could be taken from Duluth or Fort William to Montreal by the St. Lawrence in much less time than by way of Georgian Bay. He also pointed out that the season of navigation on the latter route would be shorter, and that it lay through an unsettled part of the country.

At the hearing at North Bay, the Board of Trade and other interests urged the desirability of improving the navigation of French River as a feeder to the proposed Great Lakes-St. Lawrence route. It was stated that the river is a deep stream 60 miles long, and broken only by three rapids, and that it would probably cost $20,000,000 to build canals round these in order to give a depth of 21 feet from Georgian Bay to Lake Nipissing.(1)

"ALL-AMERICAN" SHIP CANAL

This is a project that became a much discussed and advertised political issue in the State of New York during the early months of 1926. The scheme has, however, not found favor with the United States Army Engineers, but it is, neverthe-

(1) *Report of the International Joint Commission,* p. 94.

less, important on account of its strong backing in the State of New York. The project is by no means a new one as, since 1836, it is stated that 37 surveys have been made.

There are really several plans for a so-called "All-American" Ship Canal. The Bowen Lakes to the Hudson All-American Ship Canal, with a depth of 30 feet, would start from Lackawanna (Buffalo) on Lake Erie, via the Erie Canal from Tonawanda to Lockport, thence to Olcott on Lake Ontario, through the lake for 120 miles to Mexico Bay, thence via a new canal into Oneida Lake connecting there with an improved Erie Canal to Herkimer; thence via a new waterway to the Hudson River parallel to the New York State Barge Canal, but running south of Schenectady to the Hudson at Albany. The estimated cost is $500,000,000.

The most reasonable project is really for an enlarged Erie Canal, starting at Oswego instead of Buffalo, which means that the Welland Canal would be used instead of an "All-American" one between Lake Erie and Lake Ontario. The name "All-American", therefore, when applied to the entire route is a contradiction in terms. The Hon. S. Wallace Dempsey, chairman of the Rivers and Harbors Committee of Congress, is reported in the New York *Journal of Commerce,* January 21, 1926, to have stated, in reply to a suggestion from American sources that the United States should contribute to the cost of the new Welland Canal, and that the United States could establish a new route of its own between Lake Erie and Lake Ontario by constructing a canal seven miles long from LaSalle to Lewiston at a cost of $28,000,000, as compared with a possible outlay of $85,000,000 as its share of the Welland Canal improvements.

In his address before Congress on January 12, 1926, Mr. Dempsey said that he favored the route because of the unalterable refusal of the Province of Quebec, as stated by its Prime Minister, the Hon. L. A. Taschereau, to the use of the waters of the province for the generation of electric power for export to the United States. The supporters of the "All-American" route claim that, owing to this opposition on the part of Quebec, and of eastern Canada generally, the St. Lawrence Waterway project is out of the question; and, therefore, the "All-American" Ship Canal ought to be constructed to realize the desire of the United States for a deep inland waterway within its own borders.

The State of New York issued in March, 1926, an elaborate report advocating the transfer of the New York State Barge Canal to the United States Government for conversion into an "All-American" Ship Canal.(1)

The various water routes to Europe, each alternative to the St. Lawrence Route, that have been described, may be summarized as follows:

Hudson Bay Route: This is being made possible by the building of the Hudson Bay Railway from Winnipeg to Fort Churchill, a distance of 992 miles. It is intended to make this route, long used by the Hudson's Bay Company, an additional ocean outlet to Europe.

Lakes-to-the-Gulf-Deep-Waterway: The distance from Chicago to New Orleans is 1,519 miles, and the minimum depth of water when the route is opened at the end of 1931, will be nine feet.

(1) *National Problems of Canada. The Port of Montreal,* by Laurence Chalmers Tombs, p. 148-150.

Vancouver-Panama Route: The distance by water from Vancouver to Liverpool is 8,647 miles. The export of wheat by this route is increasing, and with western industrial development growing rapidly, it possesses a bright future.

COMPARISON BETWEEN THE PRESENT ST. LAWRENCE ROUTE, THE ERIE CANAL ROUTE, AND THE GEORGIAN BAY ROUTE

ST. LAWRENCE ROUTE

via Great Lakes, Welland and River St. Lawrence Canals and Montreal	Distance to Montreal	Distance Montreal to Liverpool	Total distance
Fort William to Liverpool	1,216	3,189	4,405
Duluth	1,338	3,189	4,527
Milwaukee	1,176	3,189	4,365
Chicago	1,242	3,189	4,431

ERIE CANAL ROUTE

via Great Lakes, Erie Canal, Hudson River and New York	Distance to New York	Distance New York to Liverpool	Total distance
Fort William to Liverpool	1,358	3,571	4,929
Duluth	1,480	3,571	5,051
Milwaukee	1,318	3,571	4,889
Chicago	1,384	3,571	4,955

GEORGIAN BAY ROUTE

via Great Lakes, Georgian Bay Ship Canal and Montreal	Distance to Montreal	Distance Montreal to Liverpool	Total distance
Fort William to Liverpool	934	3,189	4,123
Duluth	1,056	3,189	4,245
Milwaukee	906	3,189	4,095
Chicago	972	3,189	4,161

Chapter IX

POWER

"Mightiest powers, by deepest calms are fed,
And sleep, how oft, in things that gentlest be."—Barry Cornwall.

Chapter IX.

IN THE background of history, through countless ages, man was the only source of motive power. Beasts of burden helped him in agriculture and transportation, and he was assisted by the wind for pumping water and propelling ships. This was the age of slavery. Then came the steam engine, by which the world's work was transferred from the backs of men to machines driven by steam power. The discovery that, hidden in the rushing waters of streams and rivers were millions of horse power, ready at the call of man's genius to spring forth and be turned into light, heat and power, has carried undreamed-of comfort into the lives of people of the present day.

WORLD POWER

According to the Geological Survey of the United States Department of the Interior, the developed water power of the whole world at the end of 1926 amounted to 33,000,000 h.p., based upon the rated capacity of business installed. A summary of the developed and potential water power of the world, by continents, at the end of 1926, is estimated to be approximately:

	Developed h.p.	Potential h.p.
North America	16,800,000	66,000,000
South America	750,000	54,000,000
Europe	13,100,000	58,000,000
Asia	2,100,000	69,000,000
Africa	14,000	190,000,000
Oceania	240,000	17,000,000
Approximate totals	33,000,000	454,000,000 (1)

(1) *Developed and Potential Water Power of the World at the end of 1926.*

WATER POWER IN THE UNITED STATES

On January 1, 1929, the total capacity of water wheels installed in plants of 100 h.p. or more in the United States was 13,571,530 h.p. The State of California comes first with 16.4 and the State of New York next with 13.3 per cent of the United States total.(1)

The production of electric power by public utility plants in 1928 was 87,849,579,000 kilowatt hours, 34,695,591,000 from water power, and 53,153,988,000 from fuel (41,350,000 short tons of coal, 7,157,506 barrels of oil and 77,326,408 thousands of cubic feet of natural gas). In addition to this, there were 360,827,000 kilowatt hours of electric power produced from the use of wood. In 1928 the United States imported from Canada 1,587,207,000 kilowatt hours, and exported to Canada 5,657,000 kilowatt hours in the same period.(2)

CANADA

Many people believe that there is already so much developed water power in Canada that there is no present market available for more. This is one of the arguments used to combat the early use of power which may be created through the St. Lawrence Waterway project. This leads to the fear that, in deepening the St. Lawrence above Montreal for navigation and power, there will be no Canadian power market and, in consequence, the power will be exported to the United States and be lost to Canada. To the plain man in the street

(1) *Developed Water Power in the United States, January 1, 1929.*
(2) *Production of Electric Power by Public Utility Power Plants in the United States in 1928.*

who has had no opportunity of studying the facts this is a most natural conclusion. It will, therefore, be interesting to analyze briefly the power situation in Canada as at the beginning of 1929.

The minimum power possibilities of Canada, based on actually recorded water power resources, will permit of an ultimate turbine installation of approximately 43,000,000 h.p. Up to January 1, 1929, there has been developed 5,349,232 h.p. throughout the Dominion, or slightly less than 12½ per cent of the present recorded water power resources of the country. This available and developed horse power is distributed as follows:—

	Available 24-hour power at 80 per cent. efficiency		Turbine installation
	At ordinary min. flow H.P.	At ordinary six months flow H.P.	H.P.
British Columbia	1,931,000	5,103,500	554,792
Alberta	390,000	1,049,500	34,532
Saskatchewan	542,000	1,082,000	35
Manitoba	3,309,000	5,344,500	311,925
Ontario	5,330,000	6,940,000	1,903,705
Quebec	8,459,000	13,064,000	2,387,118
New Brunswick	87,000	120,800	67,131
Nova Scotia	20,800	128,300	74,356
Prince Edward Island	3,000	5,300	2,439
Yukon and Northwest Territories	125,200	275,300	13,199
	20,197,000	33,113,200	5,349,232

It should be noted that actual water wheel installation throughout the Dominion averages 30 per cent more than the maximum available power figures presented above in the centre column.

The known minimum water power wealth of Canada, viz., 43,000,000 h.p., based on the above authoritative figures, is estimated to be equivalent to an annual output of 143,190,000 tons of coal. At the present time the total coal output in Canada is under 20,000,000 tons per annum. This gives some idea of the enormous potential wealth which Canada has in reserve for future industrial development. It is clear that the possession of this power will give Canada a prominent world position as a manufacturing country. If we develop this power and export a large part of it, we shall simply be increasing the industrial prosperity of others and reducing our own. The development of this water power is being carried out with extraordinary speed. The total installed water power has grown from 977,171 h.p. in 1900 to 5,349,232 h.p. at the end of 1928; central electric station installation has increased from 630,518 h.p. to 4,445,693 h.p., and pulp and power installations from 151,491 h.p. to 572,926 h.p. in the same period. The pulp and paper mills buy an additional 789,500 h.p. from central electric stations, making the total h.p. used in the paper and pulp industry about 1,362,000 h.p.

The speed with which this development is taking place is rapidly increasing. Installation during 1928 alone reached a total of 550,170 h.p. while 1,200,000 h.p. additional is under construction or in active prospect.

Of Canada's known potential water power, 60 per cent is in the two non-coal producing provinces of Ontario and Quebec, as well as 80 per cent of the country's total hydraulic development. Water power installations per 1,000 of population amount to: in Quebec 902 h.p.; in Ontario 590 h.p.; Manitoba 476 h.p.; Nova Scotia 136 h.p.; New Brunswick 162 hp.; Prince Edward Island 28 h.p.; British Columbia,

with a comparatively small population, but larger power consuming industries, occupies third place in order of total installation.

Central electric stations distribute 83 per cent of the total, or 4,445,693 h.p. for domestic, municipal, street railway, commercial, power, mining and lighting purposes. The pulp and paper mills develop in their own plants 10.7 per cent, or 572,926 h.p. for their own use, and purchase from hydro-electric central stations, 789,500 h.p. more. General industrial use accounts for 6.2 per cent or 330,562 h.p. Special hydraulic installation produces 96,000 h.p. for the mines, and 339,500 h.p. is purchased by the mines from central hydro-electric stations. Without this developed water power, we should have to use coal to the extent of 18,000,000 tons per annum.

At the beginning of 1928 there were in Canada 302 central hydro-electric stations. Of these 207 are operated by private corporations and 89 by municipalities, Government commissions, or other public bodies. Commercially owned stations account for a total turbine installation of 3,200,795 h.p. while municipal stations have a total installation of 1,244,898 h.p.

CANADIAN WATER POWER DEVELOPMENT

Total turbine installation for all Canada at the end of each year, shown over periods of ten years:

(1918-1928)

1918	2,378,657 h.p.
1919	2,470,050 "
1920	2,515,559 "
1921	2,754,157 "
1922	3,008,345 "
1923	3,191,852 "
1924	3,590,596 "
1925	4,338,262 "
1926	4,549,383 "
1927	4,798,917 "
1928	5,349,232 "

It will be noted that the growth of water power development in Canada has been remarkable and this is an indication of immense industrial progress. There is no doubt that Canada's strategic advantage in the possession of large reserves of water power within transmission distance of her centres of population is luring new industries and new population to the country.

The total capital invested in water power in 1929, is estimated to be $1,172,600,000, of which 85 per cent has been expended on land, buildings, plant and generating equipment, with transmission and distribution of hydro-electric power. This works out at $219 per installed h.p. unit, including necessary transmission and distribution. It is of interest to note here that the capital cost of installed h.p. in the proposed power development on the St. Lawrence River, transmission and distribution expected, has been estimated by Professor Lesslie R. Thomson, of McGill University, at $97 for the Soulanges and $142 for the Lachine sections, while the cost in the international section has been placed at $93 per unit of h.p.

Notwithstanding this remarkable increase in the rate of developed water power there is, in eastern Canada, an actual shortage, particularly in Ontario. This is borne out by the large and growing quantities of power which the Ontario Hydro-Electric Power Commission is purchasing from Quebec. That Quebec itself is facing an early shortage of power rather than an abundance of available water power energy, is the conclusion reached by experts who have studied the question.

CANADIAN WATER

TOTAL TURBINE INSTALLATION BY PROVINCES

In

	1900	1901	1902	1903	1904	1905	1906
British Columbia	9,366	9,366	13,266	20,346	26,396	29,334	45,816
Alberta	280	280	280	355	355	355	355
Saskatchewan	...	...	...	...	...	...	...
Manitoba	1,000	1,000	1,000	1,000	1,000	1,000	38,800
Ontario	53,876	62,788	77,022	79,909	111,697	202,896	279,028
Quebec	82,864	139,149	152,783	164,258	179,468	183,799	205,211
New Brunswick	4,601	4,601	4,636	7,427	8,459	8,594	10,134
Nova Scotia	19,810	20,132	21,944	23,518	26,228	26,563	26,952
Pr. Edward Is.	1,521	1,581	1,641	1,641	1,641	1,663	1,701
Yukon	5	5	5	5	5	5	5
CANADA	173,323	238,902	272,577	298,459	355,249	454,209	608,002

	1915	1916	1917	1918	1919	1920	1921
British Columbia	254,265	288,330	297,169	307,533	308,364	309,534	310,262
Alberta	33,110	33,110	33,122	33,122	33,122	33,122	33,122
Saskatchewan	30	30	30	30	30	30	30
Manitoba	78,850	78,850	78,850	85,325	85,325	85,325	99,125
Ontario	871,309	921,158	955,955	981,313	1,036,550	1,057,422	1,165,940
Quebec	803,786	836,394	856,769	905,303	936,903	955,090	1,050,338
New Brunswick	15,405	15,480	16,251	16,311	19,126	21,976	30,976
Nova Scotia	33,596	33,656	34,051	34,318	35,193	37,623	48,908
Pr. Edward Is.	1,942	1,962	1,989	2,198	2,233	2,233	2,252
Yukon	13,199	13,199	13,199	13,199	13,199	13,199	13,199
CANADA	2,105,492	2,222,169	2,287,385	2,378,657	2,470,050	2,515,559	2,754,157

POWER DEVELOPMENT
AT THE END OF EACH YEAR SHOWN

Horsepower

Compiled, January 1, 1929

1907	1908	1909	1910	1911	1912	1913	1914
58,570	58,610	63,048	64,474	119,393	165,838	224,680	252,690
355	655	655	655	14,855	15,035	32,835	33,110
...	...	...	30	30	30	30	30
38,800	38,800	38,800	38,800	64,800	64,800	64,800	78,850
345,404	410,079	437,613	490,821	634,263	659,190	751,545	858,534
242,582	269,814	305,556	334,763	468,977	513,635	551,871	664,139
10,172	10,407	10,507	11,197	13,635	15,185	15,185	15,380
27,977	28,419	29,381	31,476	32,226	32,773	32,964	33,469
1,701	1,701	1,734	1,760	1,760	1,785	1,825	1,843
2,085	2,095	3,195	3,195	13,195	13,195	13,195	13,199
727,646	820,580	890,489	977,171	1,363,134	1,481,466	1,688,930	1,951,244

1922	1923	1924	1925	1926	1927	1928	1929
329,557	356,118	360,492	443,852	463,852	475,232	554,792	
33,122	33,122	34,532	34,532	34,532	34,532	34,532	
35	35	35	35	35	35	35	
134,025	162,025	162,025	183,925	227,925	255,925	311,925	
1,305,536	1,396,166	1,595,396	1,802,562	1,808,246	1,832,655	1,903,705	
1,099,404	1,135,481	1,312,550	1,749,975	1,886,042	2,069,518	2,387,118	
42,051	43,101	44,521	42,271	47,131	47,131	67,131	
49,142	50,331	65,572	65,637	66,147	68,416	74,356	
2,274	2,274	2,274	2,274	2,274	2,274	2,439	
13,199	13,199	13,199	13,199	13,199	13,199	13,199	
3,008,345	3,191,852	3,590,596	4,338,262	4,549,383	4,798,917	5,349,232	

ONTARIO

Water power resources of Ontario, as estimated for the Department of Lands and Forests of the province by L. V. Rorke, Director of Surveys and Chief Engineer, in co-operation with the Dominion Water Power and Reclamation Service, Department of the Interior, Ottawa, 1925, are as follows:

Taking into consideration the total potential power of the Niagara River, the figures would be 9,000,000 h.p.. The total actual developed power is, therefore, between 18 and 25 per cent, as shown by the following table:

Available and installed water power in Ontario totalled according to principal drainage basins:

Drainage basin	Estimated capacity in h.p. at 80 per cent efficiency: At ordinary minimum flow	At ordinary six months flow	Installed h.p.
Hudson Bay	26,759	53,513	...
James Bay	525,862	950,982	117,085
Lake Winnipeg	199,944	328,696	36,645
Lake Superior	181,787	303,822	90,600
Lake Huron	221,502	413,000	168,993
Lake Erie	3,292	8,923	11,367
Lake Ontario	1,054,935	1,101,060	1,030,705
St. Lawrence River	791,308	956,561	17,671
Ottawa River	423,763	708,986	112,267
Totals	3,429,152	4,825,143	1,585,333

HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO

As is well known, the Province of Ontario has adopted from the beginning the policy of public ownership for the development of her water power and the distribution of electrical energy. The Hydro-Electric Power Commission of Ontario is a co-operative municipal ownership enterprise, wide in its field, operating through the agency of independent

control and administration, and free from so-called political influence. Its history is interesting.

In 1903, the Ontario Government provided the means whereby interested municipalities could appoint a commission to investigate and report upon questions involving the supply and distribution of power. Under this authority, the municipalities of Toronto, London, Brantford, Stratford, Woodstock, Ingersoll and Guelph, joined to appoint the Ontario Power Commission. In 1906, after thorough investigation, a comprehensive report was issued showing the cost of power from coal, gas, oil and water, data respecting the consumption and future requirements of power, the cost of the development of Niagara power, and other relevant matters.

In 1906-7 the Provincial Government provided by Special Act for the creation of the Hydro-Electric Power Commission of Ontario. In 1908, thirteen municipalities contracted with the commission for a supply of electrical power from Niagara Falls. The growth and usefulness of this great co-operative effort is shown by the growth in the number of municipalities served by the commission. By the end of 1910 electrical service was being given to twelve municipalities. In 1915 there were 130; in 1920, 263; in 1925, 436, and in 1928 the commission was supplying electrical service to more than 550 municipalities.

The Hydro-Electric Power Commission is now distributing more than 1,000,000 h.p. and is operating twenty-four water power plants. Provision has been made for an aggregate amount of about 1,400,000 h.p. in the near future. This wonderful achievement under public ownership is largely due to the vision and leadership of the late Sir Adam Beck, who

for almost twenty years headed the commission. The commission now consists of the following members:

Charles A. Magrath, Chairman; Hon. J. R. Cooke, M.P.P., C. Alfred McGuire, with W. W. Pope, Secretary and Frederick A. Gaby, D. Sc., Chief Engineer.

Eight systems are now operated by the commission:

The Niagara System: This serves the district between Niagara Falls, Hamilton and Toronto on the east, and Windsor, Sarnia, Goderich on the west, with power from plants on the Niagara River. Additional supplies of power from the Gatineau and Ottawa watershed have been arranged.

Georgian Bay System: This supplies electrical energy to the territory surrounding the southern end of Georgian Bay, Lake Simcoe and the Lake of Bays district, coming from five generating stations, with additional quantities purchased from Orillia and Niagara.

The St. Lawrence System: This serves the district immediately to the north of the St. Lawrence between Brockville and Cornwall. The supply of power for this system comes from the Cedar Rapids Power Company.

The Rideau System: This serves the territory adjoining Smiths Falls, Perth and Carleton Place, the power coming from generating plants at Carleton Place and High Falls. The Rideau Power Company furnishes additional power from its plant at Merrickville.

Thunder Bay System: This serves the district at the head of the Great Lakes, including Port Arthur, Fort William and Nipigon. Power is obtained by the development of the Nipigon River.

Ottawa System: This serves the city of Ottawa and surrounding country from power purchased from the Ottawa and Hull Power and Manufacturing Company at Chaudière Falls.

Central Ontario and Trent System: This obtains its power from nine developments on the Trent and Otonabee Rivers as a by-product from dams erected for navigation, and serves the district bordering the north shore of Lake Ontario, not included in the other systems.

Nipissing System: This serves the town of North Bay and adjacent municipalities from two hydro-electric developments on the South River.

The main transmission lines of the Hydro-Electric Power Commission aggregate 3,800 miles, including 600 miles of 110,000 volt lines, and 200 miles of 220,000 volt lines, carrying power from the Gatineau River to Toronto. The com-

mission acts in an advisory capacity to all hydro utility undertakings and has designed a uniform accounting system for all its services. The capital invested in such undertakings in Ontario reached, in 1928, a total of $297,203,769 and the combined revenue in the same year was $36,388,392.

The Hydro-Electric Power Commission and co-operating municipalities have accumulated a total reserve of $76,280,930, of which the municipal reserves amount to $38,735,346. This sound financial position has been attained while providing power and light at exceptionally attractive rates. An indication of economical electrical services available to the industries, commercial houses and homes of Ontario, is afforded by the following statistics:

Of the retail power service supplied by the municipal electric undertakings, more than 35 per cent is sold in municipalities where the average rate to consumers, inclusive of all charges, is less than $20 per h.p. per year, and for about 85 per cent of the remainder the average charge is between $20 and $30 per h.p. per year. More than 90 per cent of the total kilowatt-hours sold for commercial light service are sold in municipalities where the average rate to consumers, inclusive of all charges, is less than 3 cents per kilowatt-hour. More than 85 per cent of the total kilowatt-hours sold for domestic service, including lighting, cooking and appliances, are sold in municipalities where the average rate to consumers, inclusive of all charges, is less than 2 cents per kilowatt-hour. A feature is made of encouraging the use of electricity in rural districts. Rural lines are being extended and erected at the rate of nearly 1,000 miles a year.

Thousands of Ontario farmers are now utilizing low cost electric power to drive such farm appliances as water pumps,

cream separators, churns, milking machines, buzz-saws, wood choppers, root pulpers, ensilage cutters and threshers, while the farmer, in his electrically equipped home, can enjoy the same conveniences as the city dweller, such as washing machines, irons, fans and even electric ranges. Although the service charge of rural electricity is naturally higher than in urban municipalities, nevertheless, low cost obtains. For example, to the farmer who makes full use of the service, additional energy above a certain reasonable minimum is supplied at the low rate of 1.8 cents net per kilowatt-hour.(1)

More than half the contracts now made for farm service are under Classification III—"Light Farm Service." This class includes service for lighting farm buildings, power for miscellaneous small equipment, power for single-phase motors not exceeding 3 h.p., and electric range—range and motor not to be used simultaneously. In a typical well established rural power district the monthly charge for this service to a farmer using 100 kilowatt-hours per month would be about $6.25, with an additional charge of $1.80 for each 100 kilowatt-hours additional per month.

The effect of the rural electrical services supplied by the Hydro-Electric Power Commission of Ontario upon the economic life of the province has been most marked, and is destined to have a far-reaching influence upon the happiness and prosperity of its communities.

(1) *The Hydro-Electric Power Commission of Ontario, Its Origin, Administration and Achievements.*

QUEBEC

On January 1, 1928, the total available power in the Province of Quebec (1) was estimated to be, at ordinary six months flow, 13,064,000 h.p., of which the installed turbine capacity was 2,387,118 h.p. The total actual developed power was, therefore, less than 20 per cent. Unlike Ontario, where power has been produced mostly by public ownership, the power development in the Province of Quebec has taken place through the enterprise of private corporations or individuals. During each year, for five successive years, the Province of Quebec has led in new equipment.

Let us look at the production of the seven largest power companies in the Province of Quebec, whose output equals 98 per cent of the electric energy developed. This will give a comprehensive picture of the power industry in the province in 1929. The following summary shows power available and the principal companies producing it in 1929:

The Shawinigan Water & Power Company and Subsidiary Companies:

		H.P.
Power developed and owned		624,000
Power controlled: Quebec Power Company	38,800 h.p.	
Various developments	9,200 "	
North Shore Power Co.	24,000 "	
		72,000
Power purchased:		
Duke-Price Power Company	100,000 h.p.	
Southern Canada Power Co.	10,000 "	
		110,000
Undeveloped power— including Upper St. Maurice		792,000
Power available		1,598,000

(1) *Water Power Resources of Canada,* p. 8.

Montreal Light Heat & Power Consolidated:

	H.P.
Total installation	264,000
Sold to United States and Ontario	70,000
	194,000
Purchased	135,000
Available to meet distribution requirements	329,000

Their rate of growth is about 20,000 h.p. per year, so that with the development in the Back River of 60,000 h.p., and undelivered contracts from other sources, power is available to meet demands for the next five years.

Gatineau Power Company:

		H.P.
Total installation		562,600
Under contract with Ontario Hydro-Electric Power Commission	360,000	
Required for International Paper Company	50,000	410,000
Available for general distribution		152,600

Duke-Price Power Company:

		H.P.
Estimated total installation		450,000
Provision made for installation of a further		90,000
Total installation as estimated available		540,000
Purchased by Shawinigan	100,000	
Purchased by Price Bros.	100,000	
Purchased by Lake St. John Paper Co.	20,000	
Purchased by Port Alfred Paper Co.	40,000	
Purchased by Aluminum Company	100,000	360,000
Available for an increase in the demand from present consumers for a 10,000 h.p. contract with the subsidiary distributing company and for general distribution		180,000

Demand in this territory appears to be keeping pace with hydro development.

POWER

While the Lake St. John region has abundant power resources, the demand in that territory appears to be keeping pace with hydro-development, despite the magnitude of the installations in recent years. The Alcoa Power Company is expected to bring in 240,000 h.p. from the Chute-à-Caron development in 1931.

Northern Quebec Power Company:

	H.P.
Total installation	47,000

Southern Canada Power Company:

	H.P.
Total installation	59,080

Price Bros. and Company:

	H.P.
Total installation	63,250
Purchased from Duke-Price Power Co.	100,000
Total available	163,250

THE BEAUHARNOIS POWER PROJECT

The Beauharnois power project, the construction of which was begun in July, 1929, will be among the most important water power developments yet undertaken in Canada. By creating a diversion canal 15¼ miles in length, 27 feet deep, with a bottom width of 600 feet, the Beauharnois Light, Heat and Power Corporation will not only harness the water power of the St. Lawrence between Lake St. Francis and Lake St. Louis, but will form the first deep water navigation link in the St. Lawrence above Montreal. This canal will comply with the requirements of the St. Lawrence Waterway project, for the canalization of the Soulanges section of the river, which includes the Coteau, Cedar, Split Rock and Cascades Rapids.

Present plans call for an expenditure of about $65,000,000 and the development of 500,000 h.p. by 1934. While the Beauharnois undertaking is recent, its early conception must be sought in the historic days of nearly two hundred years ago.

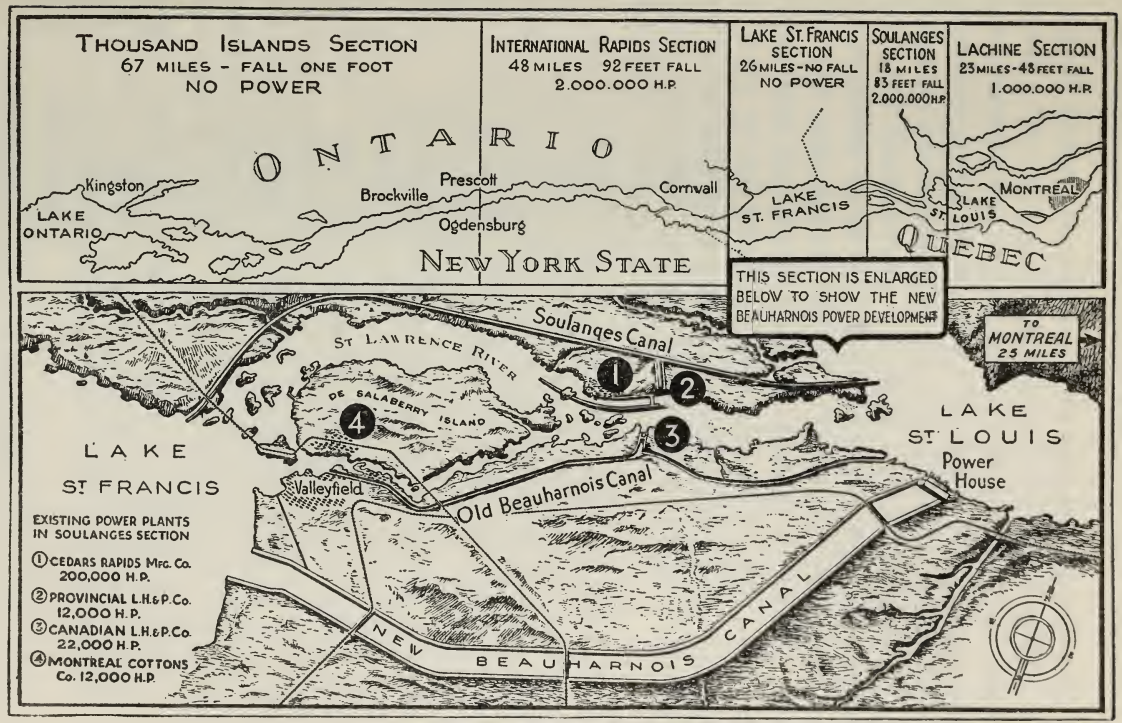
When Philippe de Rigaud, Marquis de Vaudreuil, Governor of New France, married Louise Elizabeth Joybert de Soulanges, Louis XIV was displeased. The King did not wish the aristocratic blood of Old France to mix with the colonial blood of the New World. However, the Marquis de Vaudreuil made no mistake in choosing his bride, for she was the daughter of Pierre Jacques Marie de Joybert, Chevalier de Soulanges, and a possible heiress to the Seigneuries of Soulanges and Beauharnois. Charles, Marquis de Beauharnois, became the next Governor of New France in 1726, and showed marked ability in the administration of the country, and much vision concerning its future.

Contemplating the mighty waters of the St. Lawrence from the domain of his seigneury, he it was who first visualized the power that lay hid within its waters. During his lifetime, which ended in 1746, he had constructed a small irrigation canal to connect Lake St. Francis with the St. Louis River. The object of this diversion was to increase the flow of the St. Charles River for the purpose of its hydraulic development. The original four mile diversion canal may be found on the accompanying map, just west of Valleyfield, flowing into Lake St. Louis. It is still in operation.

At a later date these seigneurial rights passed into the control of the Robert family. The Beauharnois Light, Heat and Power Company was incorporated by J. B. Robert in 1902, through a special Provincial Act, to hold the water rights owned from the beginning by his family. At the death

Aerial view of Shawinigan Falls

Courtesy Shawinigan Water and Power Company



The new Beauharnois Canal

of J. B. Robert the control of this company passed to W. H. Robert. In 1913, the attention of Sir Max Aitken, now Lord Beaverbrook, was attracted by the possibilities for power generation at this point. R. O. Sweezey, who now heads the company, first investigated the possibilities of the undertaking for Lord Beaverbrook. In 1926, R. O. Sweezey resumed investigations on his own behalf and those of his associates. The first step was the purchase by him of the Beauharnois Light, Heat and Power Company from J. B. Robert. Frank P. Jones of the Dominion Securities Corporation and other associates, then became interested; they brought to the project increased financial strength capable of assuring the successful completion of the undertaking.

In 1927 application was made to the Provincial Government for the right to amend the charter of the Beauharnois Light, Heat and Power Company. The amendments included the rights to further water, and the right to divert the water directly into Lake St. Louis instead of into the River St. Louis. But, the application was made too late in the Session to allow the Government to study the undertaking. The application was renewed in the ensuing year, when it met with the unanimous approval of the Provincial Government. On June 23, 1928, the company obtained from the Provincial Government its lease for further water to be diverted directly into Lake St. Louis. In 1929 the Beauharnois Power Corporation came into being. This is a holding company, the sole owner of Beauharnois Light, Heat and Power Company, and other subsidiaries incorporated to carry on the various activities of the project.

As the project affected a navigable river it was necessary

to obtain the sanction of the Federal Government. Finally, on March 8, 1929, the application of the company was granted by an Order in Council of the Dominion Government. The provincial lease, and the subsequent Order in Council, constitute the authority from both Provincial and Dominion Governments, under which the company is carrying out its undertaking. Summarized briefly, the rights which the company has received from the two Governments, are as follows:

(1) The right to divert 40,000 cubic feet of water per second through the canal;
(2) The canal must be 27 feet deep, 600 feet wide at the bottom, and must conform entirely with the requirements laid down by the Joint Board of Engineers for the deep water development of the river;
(3 The company's lease expires on June 23, 2003;
(4) The company will pay an annual rental to the province of $20,000 for the first five years of the lease; thereafter, the annual rental will be $50,000. In addition, the company will pay the province an annual royalty of $1 per h.p. per year;
(5) No existing interests in the river, either power or navigation, shall be adversely affected;
(6) All development plans must have the approval of both Governments;
(7) No power can be exported, directly or indirectly;
(8) The company has the right, with the authority of the province, to sell half its output to the Province of Ontario;
(9) The canal must be maintained to handle navigation; the company must supply the Government, without cost, with the land for the two necessary navigation locks, together with 3,500 h.p. for their operation;
(10) At the expiration of the lease the leased premises will revert to the province;
(11) The company must maintain all aids to navigation;
(12) The company must bear the cost of all remedial works;
(13) The Federal Government can expropriate the property at any time.

It will be noted that the Government of the Province of Quebec has safeguarded Canadian interests by prohibiting the

export of power; that it receives a substantial and progressive annual income according to the amount of power produced, and the Dominion obtains 15 miles of deep water navigation without increasing the tax burden of the people. The industrial life of Canada will get a minimum of 400,000 additional h.p.

A construction programme on a progressive basis has been laid out by the company as follows:

200,000	h.p.	by	October,	1932
300,000	"	"	"	1933
500,000	"	"	"	1934

By adopting this method the company will be enabled to purchase the necessary equipment for the entire undertaking so that the work may be carried out at the lowest cost.

TECHNICAL ADVICE

The company's plans and estimates of costs have been prepared by a board of three engineers, consisting of:

F. B. Brown, M.E.I.C., P.E.Q., Mem. Am. Soc. M.E., Mem. A.I.E.E., Consulting Engineer, Montreal.

T. H. Hogg, C.E., M.E.I.C., Mem. A.S.C.E., Chief Hydraulic Engineer, Ontario Hydro-Electric Power Commission.

W. S. Lee, M.E.I.C., Mem. A.S.C.E., Mem. A.S.M.E., Fellow A.I.E.E., Consulting engineer for the Duke interests. all of whom have been retained by the company. They have collaborated on all the company's work during the past two years, and all concur in the designs which have been adopted and upon the estimates of cost.(1)

(1) Since the above was written Frank P. Jones has sold his interests and has retired as head of the company which is now under the direction of R. O. Sweezey.

Chapter X

REFLECTIONS

"Rightness expresses of actions what straightness does of lines; there can no more be two kinds of right action than there can be two kinds of straight lines."—Herbert Spencer.

"Laws and institutions are constantly tending to gravitate. Like clocks they must be occasionally cleaned, and wound up, and set true to time."—Henry Ward Beecher.

Chapter X

In the preceding chapters an attempt has been made to examine transportation and power as factors in the world's progress; to trace briefly their history and influence on the growth of Canada and the United States, and to spread before the reading public essential and authoritative information concerning the St. Lawrence Waterway project. The views of those competent to speak for or against have been given impartially, so that the plain man may see both sides and draw his own conclusions.

I propose, therefore, in these concluding pages, to put forward certain views of my own, reflections upon the problem itself, as a contribution to the discussion of these important questions. It will hardly be denied that their magnitude and consequence demand a broad-minded consideration. Every problem has within it the elements of controversy and is surrounded by a clash of interests.

International, national, provincial and state rights are here involved. In many cases they seem to be opposed one to another, or to the particular interests of cities, towns, corporations, or individuals. Yet to my mind, the idea of ocean-going vessels coming from the Atlantic to the heart of North America through the Great River and the Great Lakes; the idea of creating 5,000,000 h.p. of new units of power for the industrial expansion of both countries, is a conception worthy of the enterprise of two peoples sprung from a common origin.

The St. Lawrence River, canals, Great Lakes, and their water connections, are joined together by international covenant and usage. In the interest of progress and amity it seems,

therefore, to be an international obligation, and a national duty, to give to this vast undertaking careful consideration based upon the utmost goodwill.

Privileged or paramount position by specially powerful groupings of wealth, numbers, or organizations, is sure to be sought. Nevertheless, it is obvious that the root principle here involved is the supremacy of the general interest of all the people over the particular interest of some of the people. In this spirit I purpose to give my thoughts upon some aspects of the problem as they appear to me.

PRELIMINARY ADJUSTMENTS

There are a number of matters of interest to both the United States and Canada concerning the proposed development of the St. Lawrence Waterway for navigation or power, which ought to be re-examined or reinterpreted and their meaning set down clearly, before any negotiations are entered into between the two nations on the larger problem:

I. We Canadians have built a St. Lawrence canal system within our own territory, which by mutual consent or by treaty, is free and open to American citizens on an equal footing with ourselves.

Americans enjoy joint use of the following Canadian canals:

Chambly,
Murray,
Ottawa,
Rideau,
St. Andrews,
St. Lawrence system, comprising the Cornwall, Lachine, Soulanges, and Williamsburg Canals, comprising the Farran Point, Galop and Rapide Plat Canals
St. Ours,
St. Peters,
Sault Ste. Marie,
Trent,
Welland,

Canadians enjoy joint use in the following American canals:

Black River,	Oswego,
Champlain or Whitehall,	St. Clair Flats,
Erie,	Sault Ste. Marie.

To a large extent American canal systems are free and open to British subjects on the same basis. The joint use of some of them on equal terms does not appear to be regulated by any definite convention. This should be set right. The canals leaving the St. Lawrence at Sorel, leading to Lake Champlain, fall within this category. It does not appear that any formal consent or agreement exists for Canadian boats to navigate Lake Champlain, the New York State canals, or the Hudson River. It may be an oversight, but if this be true, it is manifestly unfair for United States craft to have the privilege of using Canadian canals on the waterway from the Hudson River to the St. Lawrence, with full use of the St. Lawrence, while Canadians have not the same rights to navigate New York State canals, and the Hudson River. This should be adjusted.

II. Under the treaty of 1763, between Great Britain and France, the latter ceded to Great Britain, in return for equal navigation rights in the Mississippi River, all her possessions on the left bank of the Mississippi. Under the Treaty of Peace, 1783, between the United States and Great Britain, navigation of the Mississippi River was declared to be free and open to British subjects for ever on equal terms with citizens of the United States. In the treaty of 1794, between Great Britain and the United States, these navigation rights were confirmed. It is presumed that these treaty rights in the Mississippi were cancelled by the war of 1812; they should

now be renewed. In 1931 the State of Illinois will have in operation a nine foot waterway from Lake Michigan to the Mississippi, with the aid of waters belonging to Canada taken from Lake Michigan. We now enjoy, under the Boundary Waters Treaty of 1909, on an equal footing with the United States, navigation rights in Lake Michigan. The Illinois and Michigan waterway from Lake Michigan to the Mississippi should be free and open to British vessels on the same terms as to American ships, just as Canadian canals are free and open to those of the United States.

III. Undoubtedly, compensation is due to Canada for the illegal diversion of Lake Michigan waters at Chicago during the last thirty years, and for the future. Chicago is carrying out an extensive plan for modern sewage disposal, but Lake Michigan waters will still be needed to furnish water to the Illinois and Michigan Canal system, and to furnish driving force to the Chicago water power plant, now said to be yielding an annual profit of a million dollars to Chicago. Will she be able to get enough water from Lake Michigan for navigation without permanently lowering lake levels in the St. Lawrence basin? No plan has yet been suggested to save the waters of Lake Michigan for the Great Lakes-St. Lawrence basin, where they belong. Charles Evans Hughes, as Special Master of the Supreme Court of the United States, after an exhaustive examination of the facts, made the following statement in his report:

> There is no adequate supply (of water) for lockage except by diversion from Lake Michigan. Other plans would involve prohibitive expense.

If, by taking water from Lake Michigan, Chicago saves the prohibitive expense involved in finding the necessary water elsewhere, it is reasonable to expect that some indemnity be

paid for the privilege. Now is the time to determine what the damages are, to whom they are due, and who is going to pay them!

IV. Under the Treaty of Washington, 1871, the St. Lawrence River, from the international boundary to the ocean, was declared to be free and open to British and United States vessels on equal terms for ever. This is the great ocean route from Montreal to the Atlantic upon which Canada has spent many millions. Under the same treaty, the United States declared her three Alaskan rivers, Stickine, Yukon and Porcupine, to be free and open to British subjects on equal terms with American citizens for ever. To the plain man, this seems to be a one-sided arrangement which might very well be re-examined and readjusted.

V. For example, the navigation rights in the Columbia River, B.C. accorded to the Hudson's Bay Company and British subjects trading with the company, under the treaty of 1846 between the United States and Great Britain, should be readjusted and not merely confined to one branch of the river, but be extended to include the main river. These navigation rights should now be shared with Canada direct. There appears to be no valid reason why the Columbia River should not be declared free and open to Canadians on the same terms as the St. Lawrence is to Americans.

VI. Harbor dues in Great Lakes ports, Canadian and American, should be so regulated as not to become discriminating against either. These adjustments having been made we come to the point of negotiating an agreement. It should then be determined beyond any doubt whether the United States, under its Constitution, has power to make a

treaty of this kind without infringing upon any vested state rights.

Anyone who has any doubt about there being a conflict of opinion between Federal and state rights over treaty-making, navigation, and water power problems, may refer to Congressional Record—Senate, February 7, 1929, pages 3109-3116. No serious person in Canada doubts the good faith of the United States, but Canadians are naturally interested in the controversy over this problem in the United States itself. In fact, this very question has been raised by legal minds in the United States over the interpretation of Article VI of the Boundary Waters Treaty of 1909. At the hearings before the International Joint Commission in 1915, 1916, and 1920, concerning the St. Mary and Milk Rivers, the treaty making powers of the United States, Great Britain and Canada, were examined. Eminent American counsel argued as follows:

> This brings us to the question of determining the intention of the contracting parties by considering the limitations invoked upon the respective Governments by the treaty-making powers under which they were acting. . . . The powers held by the Federal Government of the United States in such matters, as well as in all matters, are enumerated powers, delegated by the States, and include only such authority as through its fundamental law has been surrendered to the general Government by the States. But the powers that may be exercised by the Government of Great Britain respecting the Dominion of Canada . . . are not thus circumscribed. . . . In other words the Government of Great Britain is not restricted in its treaty-making power, while on the other hand the United States, being a government of delegated and enumerated powers is circumscribed in its authority accordingly.

United States counsel goes on to quote from the work of the Rt. Hon. James Bryce *The American Commonwealth,* Vol. I, pages 241, 242:

> . . . There is in England no such thing as a constitution apart from the law: there is merely a mass of law consisting partly of statutes and partly of decided cases and accepted usages in conform-

ity with which the government of the country is carried on from day to day, but which is being constantly modified by fresh statutes and cases. . . . The condition of America is entirely different. There the name "Constitution" designates a particular instrument adopted in 1783, amended in some points since, which is the foundation of the National Government. This Constitution was ratified and made binding, not by Congress but by the people, acting through conventions assembled in the thirteen states which then composed the Confederation. It created a legislature of two houses, but that legislature which we call Congress, has no power to alter it in the smallest particular. Here, therefore, we observe two capital differences between England and the United States. . . . The former has placed these so-called constitutional laws at the mercy of her legislature, which can abolish when it pleases any institution of the country, the Crown, the House of Lords, the Established Church, the House of Commons, Parliament itself. The latter has placed her constitution altogether out of the reach of Congress, providing a method of amendment whose difficulty is shown by the fact that it has been very sparingly used.

For England, Parliament is omnipotent. In America, Congress is doubly restricted. It can make laws only for certain purposes specified in the constitution, and in legislating for these purposes, it must not transgress any provision of the constitution itself. The stream cannot rise above its source.

Discussing this same subject, the Hon. George F. Hoar, in comparing the Government of Canada with that of the United States, says:

In the United States all powers not granted to Congress are reserved to the States or the people. In Canada all powers granted to the Provinces are subject to the Dominion or to Great Britain. . . .

The argument proceeds:

Under the constitution of this country, Congress had no power and clearly had no right to delegate the right to make a treaty which would affect any rights wholly within the State of Montana, . . . a stream cannot rise higher than its source, hence the right to make a Treaty in violation of the Constitution cannot effectively be exercised.

The Constitution of the United States contains ten Amendments which are regarded by Americans as their Bill of Rights.

Article X of the Amendment provides:

> The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people.

American counsel went on to say that much stress had been laid on Article VI of the Federal Constitution, in regard to the treaty making powers, which reads:

> This constitution and the laws of the United States which shall be made in pursuance thereof, and all treaties made or which shall be made under the authority of the United States shall be the supreme law of the land, and the judges in every State shall be bound thereby, anything in the constitution or laws of any States to the contrary notwithstanding.

He goes on in this argument to comment on these Articles as follows:

> The authorities, including all decisions of the Supreme Court of the United States, hold that this provision has reference only to the effect which a Treaty might have on the laws of a State inconsistent or in conflict with powers delegated to the National Government through the conduit known as the Federal Constitution.
>
> As before stated, Article X of the Amendment to the Constitution above quoted was enacted after the adoption of Section 6 of the original Constitution upon which section so much reliance is had, hence, whatever construction may be placed on Article VI there can be no escape from the fact that Article X of the Amendment repeals Article VI so far as its provisions may be in conflict or inconsistent therewith.

He goes on to quote from von Holst, in his *Constitutional Law of the United States,* page 202, where may be found this axiom:

> It is a simple and self-evident principle that the treaty-making power of the nation is not *un*limited and that every treaty-making stipulation inconsistent with a provision of the Federal Constitution, is, ipso facto, null and void.

Canada is not raising the point. It is emphasised by Americans themselves, who argue that there are serious elements of disagreement as to the treaty-making power of the United

States in certain cases. In contradistinction to this situation, the Constitution of Canada is clear and unequivocal. Section 132, of the B.N.A. Act, 1867, declares:

> The Parliament and Government of Canada shall have all powers necessary or proper for performing the obligations of Canada or of any Province thereof, as part of the British Empire towards Foreign countries arising under treaties between the Empire and such Foreign countries.

The position appears to be unequal. Canada knows that she has full power to sign a treaty; the United States appears to be at the mercy of any state which calls her action in question. Neither Canada nor the United States should sign an agreement that might possibly involve them in a legal tangle and tie up their interests for a generation. The United States has full jurisdiction over navigation, but it is not yet established that she possesses jurisdiction over water power. Navigation under the sole jurisdiction of the state or province? Regardless, however, of whether or not ownership of potential power legally rests with state or province, neither can develop the power without interfering with navigation. Further development of navigation by the national authority—which is the only body vested with such authority—will develop the hydraulic powers and make them available for sale or lease. Who owns the power incidentally created by the improvement of navigation? That is the question yet to be decided.

VII. To those who have examined the plans of the St. Lawrence Waterway project, it will have been observed that the engineers have, in the international section, followed the line of least resistance and placed the route and locks so as to produce the most economic results for both navigation and power. By this arrangement, it so happens that all the locks and power houses seem to be on the American side of the

boundary, and so within American territory. Sovereignty over these will, therefore, be exclusively American. The remedy for this might be to change the international boundary in this section so that that portion of the water power belonging to each nation shall remain within its own territory.

VIII. It should be agreed beforehand that the St. Lawrence Waterway is free and open on equal terms to the vessels of all nations not at war with either the United States or Great Britain, and that in case of war between the contracting parties, vessels and ships be exempted from blockade, detention or capture by either, and this provision should include the Great Lakes and St. Lawrence River to the sea, and extend beyond the mouth of the St. Lawrence to a distance that shall not be less than the distance from the earth to the sun measured in a straight line!

IX. Provision might be made for a reference to the International Court of Justice at the Hague of all disputes for an advisory opinion, or to the International Court of Arbitration at the Hague, for a final decision.

NAVIGATION

"Honest water, which ne'er left man in the mire."
—Timon of Athens

As will have been gathered from the preceding chapters, there are four perfectly feasible deep waterways from the Great Lakes to the Atlantic Ocean. One of these is now in existence, the St. Lawrence via Montreal. Of the other three, the Buffalo to Troy, Erie Canal via New York, is only 12 feet deep; the Mississippi is also nine feet deep but has not yet a working connection with the Great Lakes. The Georgian Bay Canal has been surveyed and estimates of its cost have been made.

It is affirmed that the St. Lawrence River inland navigation system, with its maximum of 14 foot draft, will not meet the transportation demands of North American commerce in the future. This assertion is based principally on the increasing delays caused in the St. Lawrence canals by congestion of traffic. It is authoritatively stated that it now takes twice as long to pass through Canadian canals as it did five years ago.

According to Lesslie R. Thomson, "Canadian canals are now loaded to 80 per cent of their capacity and their actual physical capacity will be reached about 1938-40. As one of the wheat growing countries of the world, Canada is hampered by a 900 mile rail haul to Fort William, against an average rail haul in other countries of 330 miles. If wheat farming in the west is to remain profitable, cheapening of the water haul from Fort William to the east is essential."

There are three proposals to make this possible:

1. Deepen the inland section of the St. Lawrence and give 27 foot navigation from the Atlantic to the Great Lakes. An international highway free and open to the ships of all nations.
2. Deepen the Erie Canal system from Buffalo to Troy, New York, giving an all-American cut-off ship canal system, 30 feet deep, from Lake Erie to the Hudson river.
3. Build the Georgian Bay Canal, an all-Canadian canal and river development, via Lake Nipissing, Ottawa River to Montreal, giving 22 foot navigation from the lakes to the head of ocean navigation.

It will be seen, therefore, that neither the United States nor Canada is obliged to deepen the inland section of the St. Lawrence to possess an improved waterway to the sea. Other possible schemes are available, each being favored by different groups, each having its advantages and its drawbacks. The first choice lies with the proposed St. Lawrence Waterway

project. Notwithstanding the lure of water power development connected with the St. Lawrence project, the chief position will ultimately be conceded to navigation. After ten years of investigation, on the evidence of every technical service to which the proposed St. Lawrence Waterway project has been submitted, the scheme has been declared to be practicable, of economic advantage and of public utility. It has been declared necessary to meet the industrial expansion of both countries.

The basic factor in the economic situation of either the United States or Canada is the prosperity of the farm, the mine, and the forest. The fundamental source of the country's wealth is the land and what it produces. The purchasing power of the farmer, the miner and forester supplies the major part of the home market for manufacturing industry. The cost of transportation, therefore, is of vital consequence in the making of a prosperous community, and in reaching world markets on a competitive basis.

The present St. Lawrence Waterway is the result of deepening the natural channels, building canals and equipping harbors, out of which Canada, as a whole, has immensely benefited. This work has gone on, in successive steps, for nearly a hundred years, until we now have a thousand miles of 30 foot river navigation from the Atlantic to Montreal, 181 miles of 14 foot river and canal navigation from Montreal to Lake Ontario, and upwards of 1,000 miles of 20 foot lake navigation to Chicago, Duluth, Port Arthur and Fort William, a total of some 2,200 miles.

The proposed development of the middle inland section of 181 miles between Montreal and Lake Ontario, under the St. Lawrence Waterway project, requires the construction of only 25 miles of new canals, with only nine locks, estimated

to cost $120,155,000. This fills the gap between Montreal and the lakes as far as canals are concerned, reducing the number of locks from 22 in our present system to nine in the new, and the canal distance from 46 to 25 miles. It seems reasonable to suppose that a ship would pass through nine locks in less time than through 22. The remaining 156 miles would comprise free navigation through deep, broad, well marked river channels to Lake Ontario. The deepening of connecting channels between the Great Lakes would follow. This done, there would be a waterway open to the ships of the world, 27 feet deep and 2,200 miles long.

Will there be enough business for the new waterway? It has been variously estimated that from 11,000,000 to 30,000,000 tons of freight would be available for the St. Lawrence route if deepened. The opening of the Peace River district for settlement will add to Canada an agricultural area comprising 40,000,000 acres. A density of population not exceeding one to the acre, would give a home to the entire inhabitants of Great Britain, and add 40,000,000 to the population of Canada. Authoritative sources declare that the United States has developed her most important mineral wealth from the 5 per cent pre-Cambrian formation she possesses. The mightiest mineral field yet discovered in the world stretches across Canada from Labrador to the Pacific Ocean, in which is to be found the other 95 per cent of the pre-Cambrian formation of North America. This is coming into production.

At the present time St. Lawrence transportation is thought of largely in terms of wheat export. Twenty-seven foot navigation, and masses of water power adjacent to it, mineral development on a vast scale, larger home markets, our entry

into world markets intensively, are bound to change the character of our interior and exterior trade relations.

Suppose we had available adjacent to 27 foot navigation in the St. Lawrence 4,000,000 h.p. installed capacity and ready to distribute. We should then have something which no other country possesses—the power to produce and transport at the lowest cost. This will justify our seeking world markets as we have never done before. Suppose, further, that we had twenty-five giant industries located on the banks of the St. Lawrence attracted by this new power and transportation. Who could outbid us for our share of the world's trade? The significance of this fact has hitherto been but inadequately perceived, nor has sufficient consideration been given to the fact that international trade relations are changing, and that soon our trade policy will require readjustment to an entirely new situation. In the evolution of the world everything is in flux; change is the only stable factor that is perpetual.

Who shall say that transportation in 10,000 ton ships up and down the St. Lawrence will not revolutionize our interprovincial trade in coal, steel and fish products between the Martimes, Quebec, Ontario and the west? Or that transportation of bulk cargoes through a deepened St. Lawrence will not permit us to carry our great mineral wealth and industrial products to the markets of the world? This being so, who can deny that ultimately an improved St. Lawrence will become an additional link between the east and the west across the distances that separate our provinces one from another? Or that the thin red line of Empire trade may not be broadened by an ampler waterway than has yet been?

If we have vision and courage our great water powers adjacent to deep navigation, combined with the labor and in-

dustrial genius we possess, will give us the opportunity of becoming one of the great industrial nations of the world. Great Britain might herself wake up and take a live interest in this unique industrial situation from the point of view of Empire trade. In spite of these obvious possibilities of trade expansion, prophets are not wanting who declare a further deepening of the river to be either impracticable, foolhardy, or ruinous, just as, at the birth of the railway, far-sighted Jeremiahs foretold the impossibility of running cars over steel rails.

Look at the prophecy published by the *Ottawa Morning Journal* from the pages of London *Truth* in 1881, concerning the proposal to build the Canadian Pacific Railway:

> The Canadian Pacific Railway will run, if it is ever finished, through a country frost-bound for seven months of the year, and will connect with the western part of the Dominion, a Province which embraces about as forbidding a country as any on the face of the earth.

This choice morsel, published by a prominent British newspaper in 1881, and representing the "little Englander" type of mind, reflected only what our own Canadian newspapers of the same type had been saying about their own country, and the uselessness of building a railway into the unknown. It was the selfishness of vested interests in Canada that inspired this point of view. Luckily, all this "prattle" out of the mouths of mental babes and sucklings was of no avail or we should never have had any Canadian Pacific Railway. Beware of the "little Englander" or the "wee sma' Canadian" whose views are so myopic that he fails to visualize the dimensions of his own country or the magnitude of her requirements.

So it has been with every new problem from the beginning. The world has ever progressed in spite of the opinions of the

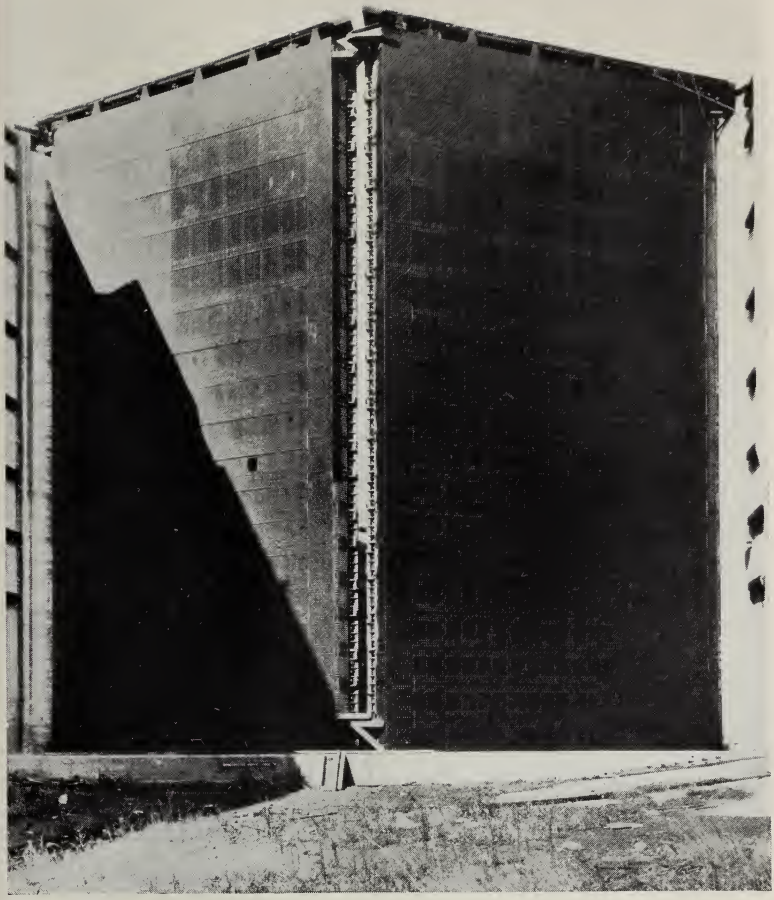
near-sighted or the prejudiced. "Where there is no vision the people perish." Voices have been raised against the St. Lawrence Waterway project on the plea that ocean ships will never go to the head of the Great Lakes through restricted navigation. This view has been put forward by shipping authorities whose opinion is entitled to respect. In the first place, what do we understand "restricted navigation" to mean? It surely cannot be from the Atlantic to Quebec, for which a ship speed of 24 knots and ships of 40,000 tons are planned; nor from the Atlantic to Montreal, where the normal ocean ship's speed is 14 to 18 knots, and the size of ships reaches 20,000 tons. This being so, all the "restricted navigation" there can be, must be found west of Montreal. How much purely "restricted navigation" is there beyond Montreal? With the proposed St. Lawrence Deep Waterway, and the new Welland Ship Canal in operation, within the whole distance from Montreal to Fort William, 1,210 miles, there would be a minimum channel depth of 27 feet, 1,085 miles of open river or lake navigation, 70 miles of restricted channels, 55 miles of canals, and 17 locks.

From Duluth to Georgian Bay ports, through Lakes Superior and Huron, there is but one lock, at Sault Ste. Marie, through which boats now pass in about fifteen minutes. From Lake Huron into Lake Erie there are no locks at all, but instead a downbound and an upbound channel through the St. Clair River, Lake St. Clair and the Detroit River, a passage of about six hours. From Lake Erie into Lake Ontario is the new Welland Canal, 30 feet deep with seven locks. It now takes about twenty hours through the old Welland Canal with its 26 locks. When the new Welland Canal is opened in 1930,

there will only be eight locks between the eastern end of Lake Ontario and the western end of Lake Superior.

The Great Lakes together form the largest body of fresh water in the world. The smallest, Ontario, is 190 miles long, 40 miles wide, with a mean depth of 300 feet and a maximum depth of 738 feet. The largest, Superior, is 383 miles long, averages 80 miles in width, with a mean depth of 475 feet and a maximum depth of 1,012 feet. The freight now carried in ships on the Great Lakes has exceeded in one year 90,000,000 tons, using 20 foot navigation. The s.s. *Lemoyne,* the largest freighter plying on the Great Lakes owned and operated by the Canada Steamship Lines, passes through the big American lock at Sault Ste. Marie in about fifteen minutes. Her dimensions are—length, 633 feet; beam, 70 feet, and she carries a cargo of 16,500 tons net. Does not the "restricted navigation" bogey seem to be removed by actual operations on the Great Lakes and St. Lawrence River in 1929?

If you want to see real restricted navigation it can be found in the Suez Canal, 100 miles long, 147 feet wide, which absorbs half its receipts in cleaning out the sand which continually silts in. Nevertheless, there passed through the Suez Canal in 1927, 5,545 ships, with a total of 28,962,043 tons. Restricted navigation which handles this amount of business justifies itself. Or, the Panama Canal, just half the length of the Suez, 300 to 1,000 feet wide, twelve locks 1,000 by 110 feet, through which there passed in 1928, 6,456 ships, with a total of 29,752,637 tons. Against this the St. Lawrence project will have only 25 miles of canal, with nine locks, the proposed dimensions of which are 766 to 859 feet long, by 80 feet wide by 30 feet deep.



Typical lock gates, new Welland Ship Canal

Official photograph, Department of the Interior, Ottawa

There is further valuable evidence to be found in the discussions surrounding the early development of the St. Lawrence itself, where the same arguments were used against the deepening of the river between Quebec and Montreal from nine to 14 feet, and from 14 to 30 feet. Yet the work has been carried out, and the ships are here to justify it.

Fifty years ago, the Hon. John Young stood on the abutment of the Victoria Bridge, Montreal, and gazing down the river toward the ocean, said to a friend:

> My friend, you cannot see all that is in my mind. From where I stand I see a world's commerce coming up the bosom of this mighty river in mighty ships, bringing this great country of ours into touch with the whole world—I see great wharves being constructed along the shores, huge elevators erected to contain the golden grain from the west, great railways and canals to bring it here, and a tremendous city to enjoy the prosperity that must come from our natural inheritance, God-given in its greatness, and may my fellow-citizens be worthy of it, be loyal enough to develop it, and keep it for their children's children.

If we had not listened to that voice there would never have been any real St. Lawrence route, nor would Montreal have become the second largest ocean port in North America. Even twenty-five years ago no one who predicted that ocean ships of 20,000 tons would come up the St. Lawrence River for 1,000 miles inland to Montreal would have been heeded. Yet the ships are here on regular service, and the business also.

In the same way, detractors flayed the proposal to construct the Panama Canal, yet in a little less than 16 years the Panama Canal has almost paid for itself. Costing originally in the neighborhood of $375,000,000, tolls to the extent of $225,000,000 have been collected from its operation. No really great achievement has ever escaped the raucuous voice of the calamity howlers.

It is significant that each continent of the world has been provided with one or two rivers transcendently great. A study of the progress of navigation in all these rivers will reveal that man's genius has been invoked to develop them to their utmost capacity. Let us briefly examine two of them.

The most important river in Europe is the Danube, a wild river, full of changing channels, sandbanks, rocks, whirlpools, and ice problems. It rises in the Black Forest of Germany and flows westward for 1,750 miles to the Black Sea, traversing several countries,—Bavaria, Switzerland, Czecho-Slovakia, Hungary and Roumania. The Danube has always been international in character, and as a matter of fact was under the Danube Navigation Commission, composed of delegates from Britain, France, Austria, Prussia, Turkey and Sardinia, from 1856 to 1914. Throughout its whole navigable length it is an example of "restricted navigation," yet, by wise improvement it has been made available for sea-going vessels up to 4,000 tons. It is quite true that the Danube is a rivulet compared with the St. Lawrence, but the size of the ships navigating its waters probably bears the same relation to its dimensions as is the case with ships navigating the St. Lawrence. The original cost of transportation on the Danube was reduced from 50 to 10 shillings a ton, the ship tonnage increased fivefold, and the average size of ships tenfold in forty years, as a consequence of deepening and improving the river channels.

The Amazon in South America, Father of Waters, 4,000 miles in length from the Atlantic to the Andes, passing through Brazil and Peru, draining an area of 2,722,000 square miles, is another example of "restricted navigation" on a large scale. Ocean ships go up to Iquitos, 2,300 miles from

the sea. Navigation of this river is not a simple matter. It appears that from November to June, during the wet season, its width varies from five to 400 miles. The torrential rains during eight months of the year turn the river into a sea, while in the dry season it shrinks, and the minimum width of the channel is 114 feet, with a minimum depth of 24 feet. At the time of the full moon each month, this huge mass of fresh water, running for 200 miles into the ocean and striking the high tides, creates waves 15 feet high. The St. Lawrence may have its shortcomings, but no such obstacles or hindrances to navigation apply to it as are applicable to many other rivers. No dangerous tides, no floods beset it; in fact, its deep, wide, well-marked channel makes it, perhaps, the safest inland channel in the world.

It has been pointed out that marine insurance rates would be excessive on the new St. Lawrence waterway. This is nothing new; marine rates on St. Lawrence business have always been excessive. No adequate allowance has ever been made in rates for the improvement to the channel in the last twenty-five years, or for the scientific aids to navigation installed by the Canadian Government during the same period. Lloyds in London are not going to reduce marine rates so long as they have no competitive rates to meet. Why should they?

The argument originating in the State of New York against the St. Lawrence Waterway project on the ground that ocean ships making the long trip inland would not pay because there would not be enough import traffic to furnish return cargoes, is worth examining. If there is any force in it, why do the same people favor digging a deep water canal across their own state from Buffalo to the Hudson River, estimated to cost double the amount of the St. Lawrence

navigation improvement, for the purpose of carrying cargoes to and from the Great Lakes? The United States imported in the first nine months of 1928 merchandise to the value of $4,146,000,000
Canada imported in the 12 months of 1928 .. 1,108,956,000

$5,254,956,000

Five and a quarter billions worth of freight imported in one year to be distributed over a continent! Lives there a man bold enough to declare that a 30 foot water route to the lakes, by way of the St. Lawrence, would attract no part of this huge trade? A voice has recently been raised to the effect that anything less than a 33 foot channel beyond Montreal to the Great Lakes would not be a practicable or efficient waterway. Experience is against this conclusion. Montreal has become the second largest seaport in North America with a 30 foot channel to the sea. But why do the great rivers of the world develop to their utmost capacity in spite of hindrances? It is because of the lure of trade and commerce. Given the trade, ships will go and get it. This is the verdict of experience.

The search for greater and cheaper transport to the sea, as far as North America is concerned, is caused by the pressure of increasing commerce—mainly from the middle-western states where population, production and business have outstripped present transport capacity. Canadian trade expansion may not yet have reached the point of demanding increased inland water transportation, but it will come. It is significant that no great river in the world serves a trade area so rich or of such variety, power and dimension as the St. Lawrence.

Why decline to deepen the inland section of the St. Lawrence to connect the centre of this continent with the oceans

of the world; why condemn to idleness the 5,000,000 h.p. concealed in the waters of the river, when we are building a new Welland Canal to a depth of 30 feet and to a navigation capacity of 10,000 ton ships, at a cost of $120,000,000. How are we going to justify the 35 foot channel below Montreal if we leave undeveloped a 25 mile gap to connect the Great Lakes with the ocean by a through channel of 27 feet depth? The new Welland Canal will represent an investment of $120,000,000, and the 35 foot channel below Montreal at least $60,000,000 more.

There seems to be an idea in the Province of Quebec that we have very little to gain from a deepened waterway to the Lakes. Let us examine this idea a little more closely. Both the ports of Montreal and Quebec are vitally interested. The maximum cargo in one vessel that can now come to either Montreal or Quebec from the lakes, is 94,000 bushels. The largest freighter now plying on the Great Lakes is the *Lemoyne,* owned by the Canada Steamship Lines. If the St. Lawrence Waterway project goes through, this one boat could bring to Montreal or Quebec, in a single cargo, 555,000 bushels of grain. Would not the great bulk cargo bring cheaper rates, more grain, and more ships to both ports?

But, say many people, we have not yet reached the capacity of our present route. True, we can, no doubt, continue as at present for some time to come. The United States, however, is not in the same position; she must have greater and cheaper water transportation to the sea. The St. Lawrence is not the only way, but it is the best and cheapest. Leave the St. Lawrence as it is, if you like. The Americans could build a new 30 foot waterway across the State of New York to the Hudson; they would then have a 30 foot waterway

from the Great Lakes to New York, and we should have a 14 foot waterway to Montreal. We could adopt the Georgian Bay Canal scheme, and get a new and shorter canal and river route to Montreal via the Ottawa River, which would improve our position somewhat. There would then be two water routes from the Great Lakes, one 30 and one 22 feet. Suppose we could make ours 30 feet; there still would be two competing routes for Great Lakes traffic. Suppose that each route got half the trade, would this be good business?

POWER

Water its living strength first shows
When obstacles its course oppose.—Goethe

Giant rivers have ever had their personality. One may recall from childhood the familiar epithets applied to many of them,—the "Ancient" Nile; the "Sacred" Ganges; the "Father of Waters" Amazon; "Ole Man Ribber" Mississippi; the "Blue" Danube; "Father" Rhine; the "Tumbling" Dee; the "Silver" Thames, and the "Mighty" St. Lawrence—mighty—full of power.

A halo of legend has surrounded these rivers in the past, but the Lorelei of olden times concealed within their waters, luring men to their destruction, are now the kilowatts of harnessed power, turning the industrial wheels of the world, and lighting our pathway.

Not one person in ten has any idea how much power there is in the St. Lawrence, in what section of the river it lies, nor to whom it belongs. Clouds of misapprehension are in the minds of many Canadians lest our big neighbor acquire predominant rights in the St. Lawrence, and fear exists that the water power, not finding a ready market in Canada, may be exported to the United States and remain there. The present

situation is that the United States owns one-half of the water power in the international section of the river; while Canada owns the other half. The rest of the power is situated in the Province of Quebec, and is wholly Canadian.

Canada can only be deprived of power developed wholly within her own territory by the stupidity of Canadians themselves. No other country in the world possesses deep water navigation and masses of power in combination, such as may be made available under the St. Lawrence scheme. If we use these rightly we may become manufacturers of goods for the markets of the world, as well as for ourselves. If we throw this opportunity away we deserve to be branded as among the most supine people of the earth.

So far as the St. Lawrence Waterway project is concerned, neither Canada nor the United States should acquire any more rights than either now possesses. By existing treaties between Great Britain and the United States, navigation in the St. Lawrence is free and open to both from one end to the other. The only part of the river where the ownership of water power is a joint affair is in the international section between Cornwall and Prescott. The water power on either side of the boundary in the international section cannot be developed without the consent of the owners, with the approval of Canada, the United States, and the International Joint Commission. The owners may ultimately be the Federal, state or provincial authorities—nobody as yet knows definitely. Navigation in the St. Lawrence is not to be jeopardized by any power development.

From Montreal westward to Lake Ontario the river is divided into five sections, the first three of which are wholly in the Province of Quebec, extending from Montreal to the

international boundary at St. Regis, just below Cornwall. It is estimated that there can be developed in the first two of these Canadian sections, Lachine and Soulanges, 2,700,000 h.p. In the third section, from the foot of Lake St. Francis to the international boundary, there is no power. In the fourth or international section from just below Cornwall to just below Prescott and Ogdensburg, there is estimated to be 2,326,000 h.p., half of which may belong to the State of New York and half to the Province of Ontario, as may be decided. This would give 1,163,000 h.p. to each. The Americans own the power developed on their side of the line and can dispose of it as they see fit; Canada may do the same. Beyond Prescott and Ogdensburg to Kingston there is no power.

The power situation here revealed is, therefore, as follows: Out of the estimated total of 5,000,000 h.p.—

Canada owns and controls	3,837,000 h.p.
United States owns and controls	1,163,000 "
Total	5,000,000 h.p.

It will be recognised that the whole benefit of power depends upon its distribution at a fair price. This can only come about if the cost of installation in the first instance is an economical one. Whether or not this be so, the boon of cheap power can be destroyed if control is not kept on the selling price. Ontario has hitherto adhered to public ownership as the principle of her water power development. Water powers in Quebec have been developed by private enterprise. Ontario, under public ownership, has created and distributed power on a large scale, selling it wholesale at cost to the various municipalities. Cost includes all interest charges; all

sinking fund charges: all renewal and contingency funds; all operating, maintenance and repair charges. With this method she has built up her industrial life, bringing cheap power and light to vast areas, thus increasing the wealth and comfort of her citizens. Quebec has developed her water power under private ownership, principally on the St. Maurice, Saguenay and Gatineau Rivers, bringing masses of power and light to new districts, promoting the birth of new towns and the establishment of new industries. In the St. Lawrence proposals, Ontario power and Quebec power are separated from each other by considerable distances, so that the different systems would not clash or interfere.

The total power connected with the St. Lawrence Waterway proposals is estimated at 5,000,000 h.p., of which 3,837,000 h.p. is within Canadian territory. With this amount of power available at a reasonable price, with deep water navigation to the markets of the world, an industrial area could be built that would successfully compete anywhere. If a free port was made of this area, like the free port of Hamburg, allowing the importation of all raw material free of duty provided it was re-exported, there could be erected one of the most intensive mass production centres in the world.

With the possession of masses of cheap power and unexcelled transportation facilities, let us make a complete survey of the situation, plot out an industrial area on the banks of the St. Lawrence; analyze Canadian imports from other countries; give our manufacturers protection enough to make their position solid; let the world know what we possess; do this, and a new home market will be born and world markets will cry out for our products.

The development of 4,000,000 installed h.p. on the St.

Lawrence would mean, according to Professor Leslie R. Thomson:

12,000 new factories;
300,000 additional employees;
1,200,000 increase in population;
$2,000,000,000 additional capital invested in Canada;
$800,000,000 additional annual wage roll—annual addition to national wealth.

On January 1, 1929, the United States had installed turbine power development amounting to 13,571,530 h.p. At the end of 1926, her ultimate potential water power was estimated when fully developed to be 35,000,000. These figures indicate that the United States has more water power developed and in use in 1929 than any other country in the world, and has in reserve yet to be developed, 23,279,000 h.p. The United States, has, therefore, no need to look to Canada for any electricity produced by water power; she has ample supplies of her own. For the above reasons Canadian water power should be developed for use in Canada, and nowhere else.

TRANSPORTATION

"One who journeying
Along a way he knows not, having crossed
A place of drear extent, before him sees
A river rushing swiftly toward the deep,
And all its tossing current white with foam,
And stops, and turns, and measures back his way."—Homer.

All Canada's transportation systems are closely related to Confederation. The Intercolonial, and the Canadian Pacific Railway, were originally built for the purpose of affording an intimate trade intercourse between the provinces, and linking up the Dominion as a whole. The St. Lawrence Waterway, from its inception, has silently contributed its strength as a link of inter-communication between the west and the east.

Its deepening beyond Montreal will afford a stronger link than before. This idea has been tersely put by Professor Thomson in his authoritative review of St. Lawrence questions. He says:

> Because it will cheapen basic east and west transportation, the waterway will make a substantial contribution to the attainment and permanent enjoyment of a goal, profoundly desired by all Canadians—a national life that will be politically free because economically sound.

What is the particular impulsion behind the proposals to increase water transport by way of the St. Lawrence? Is it to relieve the freight congestion in the western states, supposed to exist through lack of railway facilities, or is it solely a power proposition in disguise? Is the navigation portion of it merely disguise?

All the power that belongs outright to the United States in the St. Lawrence project is to be found in the international section of the river, on the American side of the boundary, and amounts to 1,163,000 h.p. The State of New York presumably owns these water power rights, which could be developed even if the St. Lawrence project had never been born. It will be perfectly clear that if power is the only objective there is no need for the present project. Anybody who can persuade himself that to develop 1,163,000 h.p. on the St. Lawrence the United States is prepared to spend millions of dollars to deepen communicating channels between the Great Lakes, deepen and equip her lake harbors to meet the new conditions, can adopt this view. On the face of it the argument does not hold.

Sensible people in the United States know that all the power they can obtain from the St. Lawrence project for use in their own country is their half of what lies in the international section of the river. If they need more power there is

no objection to their coming into Canada with their industries and getting it for use on the spot.

Furthermore, the support given to the deepening of the St. Lawrence to obtain increased transport facilities comes chiefly from the middle western states which cannot benefit directly from power in any way. The western states have too much business and too great a population for the railway facilities they possess. On the other hand, it is just as true that Canada, with her magnificent proportions and undeveloped resources, has over-equipped herself with transportation. Will not the further development of our waterways cause a reduction in railway earnings into which the Canadian people have put so much capital?

It is a matter of history in all countries that, until recently, railways have opposed the construction of canals. In England, canals built to cheapen traffic were, for the most part, eventually bought up by the railways in order to suppress competition, and fell into disuse in consequence. In the United States, it is well known that the famous New York State Barge Canal has been practically strangled by the railways which control the traffic and route it over their own systems instead of by water. Before the war the rise of Germany as a competitor in the markets of the world was largely attributible to the fact that she had developed her inland waterways and co-ordinated her rail and water traffic so as to give an unrivalled transportation system to her manufacturers, thus helping them to compete in the markets of the world.

In Canada, hitherto, railways have not raised their voices against canal traffic to any great extent, and the world over the trend is to modernise canals and co-ordinate water and rail traffic, raising both to their highest efficiency. The great pro-

portion of freight moved by rail and water in Canada consists of bulk freight, which cannot stand high transportation rates. Our present canal system competes with the railways to a very small degree; each has a field of its own where the one interferes but little with the other. The figures themselves show this.

In 1928 Canadian railways hauled 119,227,758 tons of revenue traffic, and Canadian canals handled during 1928 a net tonnage of freight originating in Canada of 16,292,000. Methods of handling rail traffic to-day, compared with the methods of even twenty-five years ago, are revolutionary. Length of trains, locomotive power, genius of management, have all tended to make transportation by rail highly efficient. On the other hand, we have left our canals as they were planned to meet conditions of long ago. Canals of 14 foot draft, and the limited size of boats, set up a limited carrying capacity. One boat of 22 foot draft in one trip will carry as much grain as a boat of 14 foot draft will carry in five trips. Hence a remarkable saving of time which, in our short season of navigation, is a most important factor. In other words, it takes over five times as long to get a million bushels of grain to Montreal, and five times as many boats, as it would by the proposed St. Lawrence project. This makes a 27 foot waterway five times as efficient as a 14 foot waterway for bulk freight, and lengthens the season of navigation enormously. An efficient waterway, therefore, takes its place alongside an efficient railway, just as an obsolete waterway lags behind it.

Every Canadian knows that the undeveloped resources of Canada will be worthy of all the transportation that can be provided, only we must not lose our heads and assume financial obligations ahead of time, and beyond our strength.

COST

"He who will eat the kernel must crack the nut."
—From the Latin.

The most serious part of the whole St. Lawrence Deep Waterway project is its cost. Present proposals put this at $840,000,000 (see table *III* Appendix *II*) for the entire project, navigation and all power, including the new Welland Canal.

The following details are taken from official sources and arranged to show, for the River Section only, the cost of navigation and power separately:

Sections: *Lachine*:	Navigation cost **	Power cost	Total installed H.P.	Total cost separate enterprises
1. Montreal to head Lake St. Louis	$55,839,000	$129,537,000	923,400	$185,376,000
Soulanges:				
2. Head of Lake St. Louis to Lake St. Francis	*34,664,000	180,711,000	1,979,700	215,375,000
Lake St. Francis:				
3. Lake St. Francis to international boundary	1,330,000	No power	No power	1,330,000
International Rapids Section:				
4. Cornwall to Prescott	81,700,000	235,005,000	2,200,000	316,705,000
5. *Thousand Islands*: Prescott to Kingston	1,532,000	No power	No power	1,532,000
	*$175,065,000	$545,253,000	5,103,100	$720,318,000

* This amount will be reduced by 13-15 millions through the building of the Beauharnois Power Project, authorized since the completion of the Joint Board Report.

** The above figures are for 27 ft. navigation and for two stage Development (No. 5-217) in International Rapids Section. They do not include interest during construction.

On examining these figures it is seen that, according to present estimates, if each nation paid for navigation and power within its own territory, and shared the cost of construction in the international rapids section, the result would be as follows:

Taking the total estimated cost at $720,318,000, Canada's share would be $561,199,500 and the United States $159,-118,500, distributed as follows:

	Navigation:	Power:	Total:
Canada	$133,449,000	$427,750,500	$561,199,500
United States	41,616,000	117,502,500	159,118,500
Total	$175,065,000	$545,253,000	$720,318,000

Professor Lesslie R. Thomson, in his address before the Engineering Institute of Canada, February 14, 1929, estimated the total costs, including Upper Lake Division and New Welland Ship Canal as follows:

Navigation	$350,000,000
Power	500,000,000
Total:	$850,000,000

He went on to say:

> The whole St. Lawrence deep waterway, including all navigational facilities (27 foot water) and all power, (5,100,000 installed h.p.) is estimated to cost $839,000,000, if both power and navigation are constructed simultaneously, and $901,000,000 if navigation and power are provided separately.

It is obvious that Canada could, under no circumstances, embark on a programme of this kind all at once. Financial sanity would forbid. Even a best friend could not ask Canada to assume an obligation like this at the present time.

As to the method of distributing the Navigational cost between the two countries, many suggestions have been made. It has been pointed out that the United States, in view of Canada's expenditures on the St. Lawrence River and her canal system, including the new Welland, amounting to date to upwards of $250,000,000; and considering the fact that the United States has enjoyed, equally with Canada, navigation privileges for over fifty years, could very well assume the cost of the proposed improvements above Montreal, leaving each country to pay for its own power development. It has been considered that an arbitrary system might be adopted whereby two-thirds of the total cost be met by the United States and one-third by Canada. It has been suggested that the whole cost be divided according to the benefits accruing to each party.

Whatever solution may ultimately be found, I would prefer separating navigation from power, asking the United States to assume the entire cost of navigation improvement for the river from St. Regis westward. The State of New York could assume the cost of the power development in her half of the international section and the Province of Ontario the cost of her half. This would leave the Province of Quebec free to develop her own power in conjunction with the Dominion, the latter assuming the cost attributable to navigation. This would divide the work geographically, so that each could carry out its own work, so far as possible in its own territory, the whole being under the supervision of an international joint commission.

In Appendix II will be found the official cost estimates prepared by the Joint Engineering Board. In Table II, column (*b*), the cost of "works solely for navigation" is estimated to be $120,155,000. The best way, perhaps, might be

Detailed Map of St.Lawrence Riv

LAKE ST. FRANCIS SECTION

CANADA
No Power

PROVINCE OF ONTARIO
Lake St Francis
PROVINCE OF QUEBEC

Boundary Lake St. Francis & Soulanges Sections

COTEAU LANDING

Soulanges Canal (24)

CEDARS

Cedars Rapids

Beauharnois Canal (25)

SOULANGES SECTION

CANADA
1 Stage 202,000 H.P.
2 " 404,000 H.P.
3 " 1,780,000 H.P.

Boundary Thousand Islands & International Rapids Sections

DOMINION OF UNITED

CANADA
1 Stage 581,500 H.P.
2 " 1,163,000 H.P.

IROQUOIS

Iroquois Point

Galop Canal (20)

CARDINAL

Point Cardinal

Galop Rapids

GALOP ISLAND

TUS I.

Chimney Point

PRESCOTT

OGDENSBURG

Rapide Plat Canal (21)

MORRISBURG

OGDEN ISLAND

WADDINGTON

CRYSLER ISLAND

Weaver Point

INTERNATIONAL RAPIDS SECTION

UNITED STATES
1 Stage 581,500 H.P.
2 " 1,163,000 H.P.

KINGSTON

Rideau Canal

West Boundary Thousand Islands Section

THOUSAND

THOUSAND ISLA

CANADA & UNIT
No Pow

Tibbetts Point

CLAYTON

iver from Montreal to Lake Ontario

ISLAND OF MONTREAL

LACHINE SECTION

CANADA
3 Stage 924,000 H.P.

Lake of The Two Mountains

St Annes Rapids

ILE PERROT

Lake St. Louis

Spit's Rock Rapids

Cascades Point

Cascades Rapids

Canal

MELOCHEVILLE

ON

LACHINE

26

Lachine Canal

MONTREAL

Montreal Waterworks Aqueduct

HERON ISLAND

Lachine Rapids

LAPRAIRIE

Boundary Soulanges & Lachine Sections

Boundary Lachine Section

REFERENCE

20 Galop Canal
21 Rapide Plat Canal
22 Farran Point Canal
23 Cornwall Canal
24 Soulanges Canal
25 Beauharnois Canal
26 Lachine Canal

FARRAN POINT

22

Farran Point Canal

Farran Point Rapids

DICKINSON LANDING

Long Sault Island

SHEEK ISLAND

LONG SAULT ISLAND

BARNHART ISLAND

Cornwall

23

Canal

CORNWALL

Robinson Bay

CANADA

STATE OF NEW YORK

STATES

MASSENA SPRINGS

CORNWALL ISLAND

ST. REGIS

Boundary International Rapids & Lake St. Francis Sections

PROVINCE OF ONTARIO

COLQUHOUN L.

Lake St Francis

PROVINCE OF QUEBEC

TION

SLANDS SECTION

UNITED STATES
o Power

ISLANDS

BROCKVILLE

Scale of Miles

1 ¾ ½ ¼ 0 1 2 3 4 5 6 7 8 9 10

to develop the Lachine, Lake St. Francis and Thousand Islands sections for navigation alone; also to complete the Soulanges section navigation works after the Beauharnois works are finished, which will be $21,500,000 instead of $31,594,000 as in the report; and also the international section, with power at the upper plant, Ogden Island alone, at a cost of $179,000,000. This would provide deep navigation; power can be obtained by the provinces as they wish. This would bring construction to a point where deepened navigation would be available, and the power problems could be taken up independently as they might be required by Canada or the United States.

It is important to remember that the St. Lawrence Waterway proposals emanate from the United States to meet her own requirements, not Canada's. The situation as it appears to me is as follows:

A bargain is proposed between two nations, one of which is vastly more powerful than the other, possesses unlimited capital, developed resources of agriculture, commerce, manufactures, and a business too great for its own transport facilities. The other nation happens to be young and vigorous, has more transportation than her present population justifies, but not nearly so far advanced with her own development, and requiring all her financial resources to meet her present commitments and extend her present equipment. While the younger nation occupies a country of similarly magnificent proportions to the older one, and possesses material resources of almost unlimited value and power, it has a population of only 10,000,000 in the same area as the big nation has 120,000,000.

Driving her trade forward at a rapid pace, the big nation

finds her own transportation facilities unequal to the demands of increasing business, and says to the younger nation:

> Join me in a waterway scheme that will immediately relieve me of the congested state of my own commerce. You may not get the benefit out of it immediately, but I will. We will divide the cost between us, and ultimately your benefits will accrue. In fifty years or so, when you grow up to be big like me, you will have something out of it as well, but in the meantime I need it at once.

In this attitude, no consideration has been given by the United States to the immense amount of work done by Canadians, or to the magnitude of Canada's expenditure on St. Lawrence improvements, in all of which the United States has participated, but to which that country has not contributed.

In considering a great international problem, the first thing to realize is that the world forces at work during the last quarter of a century have utterly changed the methods and facilities of international intercourse. This fact, escaping the minds of most persons too busy to grasp its significance, has been tersely put by Sir George Foster in an interesting article entitled "The New Internationalism" in the *Queen's Quarterly* summer number, 1929, published by Queen's University, Kingston. He says:

> Arising out of these changed conditions, and greatly facilitated by them, has emerged a growing sense of the community of interest between nations, which is rapidly countering and conquering the old selfish and pernicious idea that a nation's strength is measured by the weakness of its neighbours, and its prosperity by their impoverishment.
>
> It is more and more coming to be understood that economically considered, it is a wise policy to assist and co-operate with sister nations in such a way as to contribute to the fullest development of the diverse resources of each.

This idea of co-operation heralds the dawn of a new era in international relations, and makes possible the achievement of undertakings which, by the old methods of obstruction and

narrow-mindedness, were doomed to be submerged in the whirlpool of pettiness and jealousy.

The St. Lawrence Waterway project, now under consideration between two great peoples, should be approached in this spirit. In fact, for its ultimate successful treatment, no other attitude is possible. A navigable river and lake system, 2,200 miles long; for more than half its total length, forms the international boundary. It is owned jointly by two great nations. Furthermore, the St. Lawrence shipway below Montreal, for a distance of 1,000 miles, although wholly Canadian, has been in joint use for more than half a century by the same two nations. A proposal to enhance the value of the whole by improving the usefulness of a part cannot be the concern of one of its owners alone, nor can either undertake the intended improvement without the co-operation of the other. This being the true position, is it worth while trying to build up a sentiment against co-operation? This is an attitude unworthy of any great country. That each country has the bounden duty of protecting its own rights is not debatable, but can this not be done by co-operation better than by isolated effort? How could this be worked out?

Supposing the United States were to say:

I shall undertake the construction and financing of the entire international section of the river for navigation and power, and assume the cost of river improvements westward of St. Regis, including everything required for regulatory works necessary to preserve the proper flow and levels of the river. Before beginning the work I will acknowledge my obligation to pay for the whole of this development, in accordance with the plans agreed upon. I will, furthermore, acknowledge that equal navigation rights in the international portion of the river and lakes belong to both of us for ever.

As far as navigation is concerned, in that part of the St. Lawrence west of St. Regis to Lake Ontario, I am anxious, as you must be, to have the least costly and the most efficient plan adopted; if this

places the locks and channel in Canadian territory, you will operate them; if the locks and channels are in the United States territory, I will operate them. No matter where they are, the whole construction and operation will be under the control of an international joint commission, the presidency of which will alternate every three years between Canada and the United States.

As far as the sections of the river eastward of St. Regis are concerned, they are all in Canadian territory, and you will construct, control and operate them both for navigation and power. The development of the purely Canadian section involves much the larger expenditure, and out of all proportion to the total cost, while for some time to come, and owing to my greater population and trade, much the larger share of the benefits will accrue to me. I would consider some basis of a just partition of the total cost, so that the burden borne by each of us would be relatively just and fair.

If this attitude were adopted, the result would be an example to the whole world of co-operation raised to it highest limit.

Needless to say, the United States need not accept this suggestion any more than Canadians need accept a tax burden beyond their strength, but that country might put forward a proposal to shoulder a just share of the expense.

CONCLUSIONS

"No man so wise, but may easily err, if he take no other counsel but his own."—Ben Jonson.

Deepening of the St. Lawrence above Montreal should be undertaken only when a sound financial basis has been found that will not overload the tax burdens of the country.

No water power, wholly in Canadian territory, should be exported by Canada.

Intense industrial areas close to power and deep navigation should be developed as a new market for surplus power. When the market in Canada for Canadian power has been secured then proceed with power development.

No water rights should be given to corporations or in-

dividuals without a stipulation that all Canadian power developed shall be for use in Canada. Stock control in corporations receiving water power rights should remain in Canada.

To those Canadians who think of these great international problems in terms affecting only their own province, city, town or village, and forget that there are some questions which have to be regarded from a national point of view, I would say: The whole of Canada has contributed to the cost of the St. Lawrence ship channel;

The whole of Canada has paid for the ports of Quebec, Montreal, Halifax, Saint John and Vancouver;

The whole of Canada has paid for the new Welland Canal;

The whole of Canada will contribute to any future improvements;

The whole of Canada has shared the benefits arising from the development of these public works in the past, and she will share such benefits as may arise in the future;

The power in the Canadian section of the St. Lawrence belongs to the Canadian people and should be developed to increase the industrial prosperity of Canada.

Canada should make every effort to come to a worthy agreement with the United States of America, protecting all interests involved, and making the St. Lawrence River route available to the business and water-borne trade of the whole continent, as the cheapest and greatest waterway in the world.

We are under no obligation to be stampeded into an agreement concerning the St. Lawrence because we can build an all-Canadian route by way of Georgian Bay, and still be in a position to bid for our share of Great Lakes trade.

"Be careful a-huntin' for little parts
That you don't so fill your soul,
That you won't have room when you're finished
To take in the mighty whole."—Barry Dane.

George Washington, that great man of two countries, born British, an American by adoption and conviction, said in his farewell Presidential speech in 1796:

> Observe good faith and justice towards all Nations. Cultivate Peace and Harmony with all. Religion and Morality enjoin this conduct; and can it be that good policy does not equally enjoin it? It will be worthy of a free, enlightened, and at no distant date, a great nation, to give to Mankind the magnanimous and too novel example of a People always guided by an exalted justice and benevolence.

APPENDICES

APPENDIX I

CONVENTION AND PROTOCOL BETWEEN CANADA AND THE UNITED STATES REGARDING THE NIAGARA FALLS AND THE NIAGARA RIVER

TEXT OF CONVENTION

His Majesty the King of Great Britain, Ireland and the British Dominions beyond the Seas, Emperor of India,

And the President of the United States of America;

Considering that a Special International Niagara Board was established in 1926 by the Government of the Dominion of Canada and the Government of the United States to study and submit to the two Governments a report upon certain questions relating to the Niagara Falls and the Niagara River, more particularly the questions how the scenic beauty of the Niagara Falls and Rapids could be best maintained, by what means and to what extent the impairment thereof by erosion or otherwise might be overcome and prevented, and what quantity of water might consistent therewith be diverted from the river above the Falls;

And that on the fourteenth day of December, 1927, the said Special International Niagara Board submitted to the two Governments an interim report recommending the construction of certain works in the Niagara River for preserving and improving the scenic beauty of the Falls and Rapids;

And considering that Article 5 of the treaty with respect to the boundary waters between Canada and the United States, concluded between His Majesty and the United States of America, on January 11th, 1909, limits the quantity of water which may be withdrawn from the Niagara River above the Falls;

And that the Special International Niagara Board considers it desirable to make temporary diversions of water from the Niagara River above the Falls in excess of those permitted by Article 5 of the treaty of 1909, as a means of observing and testing the efficacy of the proposed works under widely varying conditions;

Have deemed it necessary to preserve and improve the scenic beauty of the Niagara Falls and Rapids, and to that end to adopt the recommendations of the said Special International Niagara Board, and have resolved to conclude a Convention, and for that purpose have appointed as their respective Plenipotentiaries:

His Britannic Majesty, for the Dominion of Canada: The Right Honourable William Lyon Mackenzie King, Prime Minister and Secretary of State for External Affairs; and

The President: The Honourable William Phillips, Envoy Extraordinary and Minister Plenipotentiary of the United States of America to Canada;

Who, after having communicated to one another their full powers, found in good and due form, have agreed upon the following Articles:

Article I: The High Contracting Parties agree that remedial works shall be constructed in the Niagara River above the Niagara Falls, designed to distribute the waters of the river so as to ensure at all seasons unbroken crestlines on both the Canadian and the Americans Falls and an enhancement of their present scenic beauty.

Article II: Concurrently with the construction and tests of the remedial works and as a temporary and experimental measure, diversions of the waters of the Niagara River above the Falls from the natural course and streams thereof addi-

tional to the amounts specified in Article 5 of the Boundary Waters Treaty of January 11th, 1909, may be permitted to the extent and subject to the conditions hereinafter provided:

(1) The additional diversions shall be permitted only within the period beginning each year on the first day of October and ending on the thirty-first day of March of the following year, both dates inclusive.

(2) The additional diversion to be permitted within the State of New York shall not exceed in the aggregate a daily diversion at the rate of ten thousand cubic feet of water per second.

(3) The additional diversion to be permitted within the Province of Ontario shall not exceed in the aggregate a daily diversion at the rate of ten thousand cubic feet of water per second.

(4) The provisions of this Article shall terminate seven years from the date of the initial additional diversion authorized under this Convention.

Article III: The present Convention shall be ratified by His Britannic Majesty in accordance with constitutional practice, and by the President of the United States of America by and with the advice and consent of the Senate thereof. The ratifications shall be exchanged at Ottawa as soon as possible and the Convention shall take effect on the date of the exchange of ratifications.

In Faith Whereof the respective Plenipotentiaries have signed this Convention in duplicate and have hereto affixed their seals.

Done at Ottawa on the second day of January in the year of Our Lord One Thousand Nine Hundred and Twenty-nine.

(L.S.) W. L. Mackenzie King.
(L.S.) William Phillips.

APPENDIX II

A GENERAL ANALYSIS OF COSTS

TABLE I.—*Recommended plans with single-stage development in international power section. Estimates covering 25 foot navigation, not including interest during construction*

(a) Section	(b) Cost of works solely for navigation	(c) Cost of wosks primarily for power	(d Cost of works jointly for power and navigation	(e) Total cost with complete initial power installation	(f) Initial cost if one-half initial power installation is deferred	(g) Complete Installed capacity of initial works, provided in estimate column (e
						Horsepower
Thousand Islands.....	$ 1,100,000	.....	.....	$ 1,100,000	$ 1.100,000	.....
International Rapids...	22,000,000	$106,500,000	$106,500,000	235,000,000	*203,000,000	2,326,000
Lake St. Francis	980,000	.....	.....	980,000	980,000	.....
Soulanges,.....	31,594,000	37,665,000	34,686,000	103,945,000	92,000,000	404,300
Lachine.....	53,000,000	.....	.....	53,000,000	53,000,000	.....
Total	108,674,000	144;165,000	141,186,000	394,025,000	*350,080,000	2,730,300

* Including $13,000,000 for channel enlargement to assure winter operation.

TABLE II.—*Recommended plans with two-stage development in the international power section, covering 25 foot navigation, not including interest during construction*

(a) Section	(b) Cost of works solely for navigation	(c) Cost of works primarily for power	(d) Cost of works jointly for power and navigation	(e) Total cost with complete initial power installation	(f) Initial cost if one-half initial power installation is deferred	(g) Complete installed capacity of initial works, provided in estimate column (e
						Horsepower
Thousand Islands.....	$ 1,100,000	.....	.....	$ 1,100,000	$ 1,100,000	.....
International Rapids...	33.481,000	$140,209,000	$90,656,000	264,546,000	*238,400,000	2,2I5,000
Lake St. Francis.....	980,000	.....	.....	980,000	980,000	.....
Soulanges.....	31,594,000	37,665.000	34,686,000	103,945,000	92,000,000	404,300
Lachine.....	53,000,000	.....	.....	53,000,000	53,000,000	.....
Total	120,155,000	177,874,000	125,542,000	423,571,000	†385.480,000	2,6I9,300

* This becomes $214,500,000 if installation is at Barnhart Island power houses.

† This becomes $361,580,000 if initial installation in International Rapids section is at Barnhart Island power houses.

TABLE III—DIGEST OF ESTIMATED CAPITAL COSTS on one specific illustrations of Navigational and Power capital costs.

ASSUMPTIONS AND CONDITIONS: *General*—Two-stage development for Col. B. Costs are *without* interest

	Estimated costs, as given by Joint Board, for development solely as a :		Estimated installed horse power	Estimated cost of	
	Navigation enterprise	Power enterprise		Developing power and navigation as *separate* enterprises	A *combined* navigation and power development
	A	B	C	D	E
Great Lakes Division:				A+B	
Channels between Upper Lakes	$54,900,000				
Lock at Sault Ste. Marie	6,500,000				
Compensating works	3,700,000				
New Welland ship canal	115,600,000				
Group total	180,700,000			$180,700,000	$180,700,000
River Division:					
Thousand Island Section	1,532,000	.....	.....	1,532,000	1,532,000
International Rapids Section	81,700,000	$235,005,000	2,200,000	316,705,000	270,256,000
Lake St. Francis Section	1,330,000	.....	.....	1,330,000	1,330,000
Soulanges Section	*34,664,000	180,711,000	1,979,700	215,375,000	206,317,000
Lachine Section	55,839,000	129,537,000	923,400	185,376,000	179,052,000
Group total	175,065,000			720,318,000	658,487,000
Grand total	355,765,000	545,253,000	5,103,100	901,018,000	839,187,000

*This amount will be reduced by 13-15 millions through the building of the Beauharnois Power Project, authorized since the completion of the Joint Board report.

solution of the whole St. Lawrence Deep Waterway Development, with suggested

Courtesy of the Engineering Institute of Canada.

Specific—Two-stage development (No. 5-217) for Cols. E and J. All navigation 27 ft. during construction.

Decrease or "savings" due to constructing work as a *combined* enterprise	Estimated capital costs, if constructed as a *combined* enterprise, chargeable to St. L. D. W. as a:					
	Navigation Project			Power Project		
	Basis 1	Basis 2	Basis 3	Basis 1	Basis 2	Basis 3
F	G	H	J	K	L	M
D minus E	Same as A	E minus B	Nav.+½ Joint	Same as B	E minus A	Power+½ Joint
.....	$180,700,000	$180,700,000	$180,700,000			
.....	1,532,000	1,532,000	1,532,000			
$46,449,000	81,700,000	35,251,000	85,056,000	$235,005,000	$188,556,000	$185,200,000
.....	1,330,000	1,330,000	1,330,000			
9,058,000	34,664,000	25,606,000	50,202,000	180,711,000	171,653,000	156,115,000
6,324,000	55,839,000	49,515,000	55,839,000	129,537,000	123,213,000	123,213,000
.....	175,065,000	113,234,000	193,959,000			
61,831,000	355,765,000	293,934,000	374,659,000	545,253,000	483,422,000	464,528,000

Quoted phrases are from Joint Board estimates.

Basis 1: Development solely for "navigation" or solely for "power."

Basis 2: "Navigation" cost is cost of combined development minus cost of "solely-for-power" development, and vice versa.

Basis 3: "Navigation" cost is cost of "works primarily for navigation" plus one-half cost of "works jointly for navigation and power," and vice versa.

APPENDIX III

Information regarding the work of deepening the channel of the St. Lawrence River from 30 to 35 feet between Montreal and Quebec: (1)

SEASON 1928

	Length of Dredging			
	Yet to be done Miles	Done Miles	Cubic Yards Yet to be Dredged	Cubic Yards Dredged
Division No. 1:				
Longueuil Shoal to Sorel	2.33	24.47	970,210	14,652,798
Division No. 2:				
Sorel to Pte. Citrouille, omitting Lake St. Peter	6.81	13.63	5,235,432	8,445,403
Division No. 3:				
Lake St. Peter	0.52	17.80	530,320	11,966,832
Division No. 4:				
Batiscan to St. Augustin	15.41	0.13	9,116,082	81,125
Division No. 5:				
Quebec to Goose Cape	6.30	4.49	5,570,576	17,921,353
Totals	31.37	60.52	21,422,620	53,067,511

Owing to the increase in the size of vessels coming to Montreal the widening and flattening of curves has become necessary. This was not considered in the original project and, consequently, the additional work has delayed the completion of the 35 foot channel. Comparing the work carried out in 1928 with what remains to be completed, it would appear that the 35 foot dredging could be finished in eight

(1) From information supplied by the Department of Marine and Fisheries, Marine Branch, April 18, 1929.

years from April, 1929. But, on account of the widening and flattening that is necessary, this will not be possible, and a considerably longer period will be required.

During 1928, 2,627,985 cubic yards of material were excavated. It is impossible to state a definite date for the completion of the 35 foot project. The material to be dredged may be classified as hard, and included in it is 1,500,000 to 2,000,000 yards of shale rock to be moved.

APPENDIX IV

In the matter of a reference as to the relative rights of the Dominion and provinces in relation to the proprietary interests in and legislative control over waters with respect to navigation and water-powers created or made available by or in connection with works for the improvement of navigation.

Question 1 (*a*) Where the bed of a navigable river is vested in the Crown in the right of the province, is the title subordinate to the public right navigation?

Question 1 (*b*) If not, has the Dominion the legislative power to declare that such title is subordinate to such right?

Answer:

The questions framed postulate the existence of a public right of navigation in the rivers to which they refer, as well as their navigability.

The title to the bed of the river is subject to that public right, except in so far as, at the date of the Union, the Crown possessed by law or has since acquired, under Dominion legislation, a superior right to use or to grant the use of the waters of the river for other purposes, such for example, as mining, irrigation or industry.

Question 2. Where the bed of a navigable river is vested in the Crown in the right of the province, has the Dominion power, for navigation purposes, to use or occupy part of such bed or to divert, diminish, or change the flow over such bed (*a*) without the consent of the province; (*b*) without compensation?

Question 3. Has the Parliament of Canada the power, by appropriate legislative enactment, to authorize the Dominion

Government to expropriate the lands of the Crown in the right of the province for the purposes of navigation with provision or without provision for compensation?

Answer:

These questions cannot be answered categorically either in the affirmative or in the negative.

The conditions controlling the exercise of Dominion legislative powers for purposes embraced within the comprehensive phrase, "navigation purposes," depend in part upon the nature of the purpose, in part upon the nature of the means proposed for accomplishing it, and in part upon the character of the particular power called into play. Reference is respectfully made to the observations in the accompanying reasons, as indicating the governing principles with as much definiteness as is safe or practicable.

Question 4. By section 108 of the British North America Act, 1867, and the first item of the Third Schedule thereto, the following public works and property of each province, amongst others, shall be the property of Canada, namely "Canals with lands and water-power connected therewith."

Has the province any proprietary interest in or beneficial ownership of or legislative control over the water-power which, though connected with the said canals, is created or made available by reason of extensions, enlargements or replacements of said canals made by the Dominion since Confederation and which is not required from time to time for the purpose of navigation?

Question 5. Where the bed of a navigable river is vested in the Crown in the right of the province, has the province any proprietary interest in or beneficial ownership of or legislative control over the waterpower created or made

available by works for the improvement of navigation constructed thereupon in whole or in part by or under the authority of the Dominion since Confederation which is not required from time to time for the purposes of navigation?

Answer:

Whatever subjects are comprehended under the phrase "Water-Power" in the 1st item of the third schedule, by section 106 passed to the Dominion. There was left to the provinces neither proprietary interest in, nor beneficial ownership of such subjects; and under section 91 (1) legislative control over them is exclusively committed to the Dominion.

As to water-powers (and these of course, are not comprised within that item) "created or made available by reason of extensions, enlargements or replacements made by the Dominion since Confederation" or "by works for the improvement of navigation constructed in whole or in part since Confederation," it is impossible to ascertain the respective powers or rights of the Dominion and the provinces in relation thereto, in the absence of a more precise statement as to the character of the works, as to the legislative authority under which the works were executed, and as to the circumstances pertinent to the question whether or not the conditions of such authority were duly observed.

Question 6 (*a*). Has the Dominion exclusive proprietary interest in or beneficial ownership of or legislative control over water-powers created or made available by works authorized by Parliament to be erected in any boundary waters for the purpose of carrying out a treaty between His Majesty and a foreign country providing for the erection of joint works for (1) the improvement of navigation in such waters, or (2) for the development of power, or (3) for both?

The expression "boundary waters" in this question means the waters defined by the preliminary article of the Treaty dated 11th January, 1909, between His Britannic Majesty and the United States of America.

Question 6 (*b*). If the Dominion has not the exclusive proprietary interest in or beneficial ownership of or legislative control over such water-powers, has the province the exclusive proprietary interest in or beneficial ownership of or legislative control over such water-powers?

Answer:

The nature and extent of the respective powers, rights and interests of the Dominion and the provinces in, and in respect of such water-powers, would depend upon a variety of facts, including, *inter alia,* the terms of the Treaty, and the respective rights of the Dominion and the provinces in, and in relation to the waters affected. In the absence of information as to such facts, it is impracticable to give an intelligible answer to the questions propounded.

Question 7. Has the Parliament of Canada legislative power to authorize the construction and operation by the Dominion Government of works wholly for power purposes and the acquisition by purchase of expropriation of the lands and property required for the purposes of such works including lands of the Crown in the right of a province (*a*) in inter-provincial rivers; and (*b*) in provincial rivers?

"Interprovincial rivers" in this question means rivers flowing along or across the boundaries between provinces.

Answer:

As to both "provincial rivers" and "interprovincial rivers," Parliament has jurisdiction in respect of such works, if they fall within the ambit of sec. 92 (10*a*). With reference to the

expropriation of provincial Crown lands "for the purposes of such works," the answer to the question would, to some extent, depend upon the particular purpose for which such lands were required. In answering this question, sec. 92 (10*c*) is not taken into account. Reference is respectfully made to what has been said upon that subject in the accompanying reasons.

Question 8. May a province notwithstanding the construction by the Dominion for the purposes of navigation of works in a river the bed of which is within such province, control, regulate and use the waters in such river so long as such control, regulation and use does not interfere with navigation? In the case of a river flowing between two provinces may such provinces jointly control, regulate and use the water in the same manner?

Question 9. Has a province the right to control or use the waters in provincial rivers and to develop or authorize the development of waterpowers within the province provided that in so doing navigation is not prejudiced and that the province complies with Dominion requirements as to navigation?

Answer:

These two questions mutually overlap, and it is convenient to deal with them together. If there is no valid conflicting legislation by the Dominion under an overriding power—the power for example bestowed upon the Dominion by sec. 92 (10*a*)—the several provinces have the rights which are the subject of interrogatory number 9.

As to the first branch of the eighth question. The authority of the provinces to "control, regulate and use" such waters, in the circumstances mentioned, is subject to the condition

that, in the exercise thereof, the provinces do not interfere in the matters the control of which is reserved exclusively for the Dominion, and that all valid enactments of the Dominion, in relation to the navigation works, or in relation to navigable waters, be duly observed.

This condition is not necessarily identical with the condition expressed in the question by the words "so long as such control, regulation and use does not interfere with navigation." The question therefore, in the form in which it is put, cannot be answered in the affirmative; and, as the exercise of legislative jurisdiction, in the comprehensive terms of the question, might encroach upon the exclusive jurisdiction of the Dominion, the proper answer seems to be in the negative.

As to the second branch, considering the variety of meanings which might attach to the phrase "jointly control, regulate and use," no precise or useful answer is possible.

The answers to these questions, conformably to the views adverted to above, also proceed upon the assumption that the questions have no reference to any jurisdiction which might be acquired by the procedure laid in sec. 92 (10*c*).

Question 10. (*a*) If question 4 is answered in the affirmative, what is the nature or extent of such interest or ownership or control?

(*b*) If question 5 is answered in the affirmative, what is the nature or extent of such interest or ownership or control?

(*c*) If the answers to both questions 6 (*a*) and 6 (*b*) are in the negative, what are the respective rights and interests of the Dominion and the provinces in relation to such water-powers?

Answer:

In view of what has already been stated in response to the 4th, 5th and 6th interrogatories, no answer to this question is called for.

* * *

The impracticability of answering the questions submitted is dealt with by the Court in the conclusion of the reasons for judgment. Sufficient has been said, it is stated, to call attention to the difficulty, indeed the impracticability, of giving precise and categorical answers to some of the questions submitted. As regards most of them, the limit of practicability seems to be reached, when the principles to which reference must be made for the determination of particular cases have been indicated. The authority of the Governor in Council to submit these questions under the statute, and the validity of the statute itself are no longer open to question; and it is the duty of the judges of this court to endeavour, to the utmost of their powers, to return to His Excellency answers as precise and as useful as the questions admit of. Nevertheless the Privy Council has recognized, more than once, that, in the exercise of the statutory authority, interrogatories may through inadvertence be presented, to which it is not possible to give accurate or exhaustive answers, or indeed any answers which are not so encumbered by qualifications and reservations as to deprive them of all practical value.

The reasons for judgment proceeded:

It is important, also, since the opinions evoked by such questions, "are of course," as Lord Loreburn states in the same passage, "only advisory, and will have no more effect than opinions of the law officers," to observe that, when a concrete case is presented for the practical application of the principles

discussed, it may be found necessary, under the light derived from a survey of the facts, to modify the statement of such views as are herein expressed.

The reasons refer to section 91 and 92 of the B.N.A. Act, under which the powers of the Dominion and the provinces are set out.

By section 91, it is stated, the Dominion was given power to raise money, by any mode or system of taxation, and by section 92, each of the provinces was given the power to raise a revenue for provincial purposes by direct taxation, and by means of licenses.

It has never been suggested that either the Dominion alone or a province alone is entitled to alter the terms of this arrangement for the distribution of assets, liabilities and sources of revenue.

A large number of decisions of the Supreme Court of Canada and the Privy Council in England are reviewed.

The effect of the decisions seems to be, the reasons for judgment proceeded, that neither the Dominion nor a province can take possession of a source of revenue which has been assigned to the other, and as a source of revenue, appropriate it to itself, nor, as owner, transfer it to another.

This, of course, is not to say that the Dominion in exercising its legislative authority under section 91, may not legislate in such a way as to affect the proprietary rights of a province. It is plain that in consequence of legislation on the subject, for example of Fisheries, the provinces may be very greatly restricted in the exercise of their proprietary rights; but so long as the Dominion legislation truly concerns the subject of "Fisheries," as that subject is envisaged by section 91, such legislation has the force of law, however harmful, or

even foolish, it may appear to be. Within the limits of the subject matters assigned to it, the authority of the Dominion is supreme, and no court of justice has jurisdiction to take cognizance of any complaint that such authority has been abused.

The extent to which the provincial legislatures may be restricted in, or excluded from, the control of provincial property by the enactment of Dominion laws operative under section 91 cannot be defined in the abstract. That depends primarily upon the character of the particular authority which the Dominion is exercising. On the present Reference, the discussion has been largely concerned with the legislative authority of the Dominion Parliament in relation to the permanent occupation of Provincial Crown lands, and the permanent diversion and alteration of the flow of rivers and streams in derogation of the rights of a province, as proprietor of the beds of such rivers and streams, for purposes which have been compendiously styled, in the interrogatories, "navigation purposes."

The reasons for judgment point out that there is judicial sanction for the view that the authority given to the Dominion under section 91, sub-section 10, respecting navigation and shipping, does not, in its essence, include the power to authorize the permanent occupation of provincial lands for harbor works, or to vest the bed of a river belonging to a province on a board of harbor commissioners for harbor purposes; that such a power, if it exists, is in the nature of an ancillary power, "and can only be exercised upon the condition of paying compensation to the province."

Reference is made to the claim advanced by counsel for the Dominion during the hearing before the Court last October,

for much more sweeping jurisdiction. It was argued, the reasons for judgment mentioned, that to deny the Dominion Parliament an unrestricted discretion in disposing of provincial property for purposes within the enumerated heads of section 91 of the B.N.A. Act, was equivalent to denying the plenary character of the Dominion legislative authority. It was further contended for the Dominion that the provincial contention in the opposite sense had no other basis than the possibility that legislative powers of the Dominion, "as interpreted by the Dominion, in argument," might be abused, to the injury of the provinces, a "consideration inadmissable in a court of law." With this contention of the Dominion for much more sweeping jurisdiction, the Court does not agree.

The reasons for judgment proceed:

But although the Dominion may, by legislation enacted in exercise of its exclusive powers relating to railways and canals, authorize the construction through the property of a province of a railway or canal, to which its jurisdiction extends, this does not involve the right to appropriate the whole beneficial interest of the site of the work (including the minerals, for example), for the purpose of making it available as an asset or source of revenue for the benefit of the Dominion or of the Dominion's grantees, where that site is vested in His Majesty and is, by the B.N.A. Act, subject to the administration and control of the Provincial legislature.

Apart from the fact that such legislation would not be legislation exclusively competent to the Dominion, it would transcend the ambit of Dominion authority touching railways or canals, which was not intended to enable the Dominion to take possession of sources of revenue assigned to the provinces, and by assuming the administration of them, to ap-

propriate to itself a field of jurisdiction belonging exclusively to the provinces. Similar considerations apply to the exploitation and disposition of water-powers appropriated by the Dominion in exercise of its legislative authority in relation to canals. Assuming such an appropriation by the Dominion to be competent without payment of compensation, the Dominion could not constitutionally assume the administration or control of water-powers so acquired for purposes not connected with the canal.

We must, as best we can, reconcile the control by the provinces of their own assets as assets, with the exercise by the Dominion of its exclusive powers for the purposes which those powers were intended to subserve. This can only be accomplished by recognizing that the proprietary rights of the provinces may be prejudicially affected, even to the point of rendering them economically valueless, through the exercise by the Dominion of its exclusive and plenary powers of legislation under the enumerated heads of section 91. On the other hand, in giving effect to the provisions of the British North America Act, we must rigorously adhere to the radical distinction between these two classes of enactment; legislation in execution of the Dominion's legislative powers under section 91, which may, in greater or less degree, according to the circumstances and the nature of the power, affect the proprietary rights of the provinces, and even exclude them from any effective control of their property; and in contradistinction legislation conceived with the purpose of intervening in the control and disposition of provincial assets, in a manner, which, under the enactments of that Act touching the distribution of assets, revenues and liabilities, is exclusively competent to the provinces.

Question 8 in the reference is a subject of considerable comment in the reasons for judgment.

It would not be a sufficient recognition of the jurisdiction of the Dominion to affirm that, in the circumstances mentioned in the question, a province is entitled to regulate and control the waters of the river so long as navigation is not interfered with. The obligation of the province in such circumstances is much more definite and precise, as has just been stated. The exercise of jurisdiction by a province, in a manner permitted by the terms of the question, might constitute a substantial encroachment upon the exclusive authority of the Dominion. [1]

(1) This Appendix has been compiled from information supplied by the Registrar of the Supreme Court of Canada; also, from an article in *The Gazette,* Montreal, February 6, 1929.

APPENDIX V.

OUTLINE CHART OF THE CLAIMS AND ARGUMENTS ADVANCED BY THE SUPPORTERS OF THE ST. LAWRENCE PROJECT

NOTE: The matter on this and the following page is a compilation only of the arguments advanced for and against the project, and is not to be necessarily considered as an endorsement of it.

AS TO TRANSPORTATION	First of all: the project would meet that most urgent need—more and better transportation:	The business of the United States, particularly that of the tremendously important area tributary to the Great Lakes, has entirely outstripped the present trackage and rolling stock capacities and terminal facilities of the railroads; in other words, conditions have now come to a point where transportation facilities positively must be increased. But the capacity and equipment of the railroads cannot possibly be enlarged to the requisite point except at an entirely prohibitive cost; consequently, the further development of water transportation is the only practicable move, and the St. Lawrence is the natural and proper route. Its development would greatly increase the freight carrying capacity of the country, entirely relieving the present freight congestion, and, in particular, serving to efficiently handle the maximum freight load, the crop movement, and business which the railroads cannot now carry without absolutely neglecting other freight. Even at that they experience serious congestion every fall. The St. Lawrence route would ameliorate all these conditions, and in every way be a great boon to the farmer, the manufacturer, the dealer, and the consumer. Further, it would, of course, increase the capacity and improve the facilities for carrying inbound freight also, both raw material and manufactured goods. From the railroads' point of view it would equalize the month to month demand on their trackage, their rolling stock, and their terminals; thus tending to greatly reduce their operating expenditures. This, in turn, would increase their net earning powers, besides which it would enable them to give greatly improved service to the communities among which they operate.
	IN SHORT: The development of the St. Lawrence would provide those increased and improved transportation facilities which are an absolute and imperative necessity to the whole community, and which cannot be economically obtained in any other way.	
	Moreover, this increased and improved transportation would be cheaper:	Because water carriage is inherently less costly than land carriage. Because the waterway would greatly reduce present terminal costs and transfer and storage charges. Because, in many cases, the mileage would be reduced; for instance, the distances from Duluth, Windsor, Toledo, Hamilton, etc., to such a point as Liverpool are much less via the St. Lawrence than via New York, or any other eastern seaboard city.
	And quicker:	Because, in miles per day, the average boat speed is greater than the average freight car speed. Because, the present delays in transferring from rail to boat, rail to barge, barge to ship, etc., would either be eliminated or else very much reduced.
	And more reliable:	Because the St. Lawrence route is reliable, and easily navigable, and goods or materials, once on a boat, as a rule reach their destination without transfer, and in any case can be easily traced. As against this, rail shipments are frequently lost for months at a time; in fact, they not infrequently disappear entirely.
	Would greatly benefit manufacturing and commerce generally:	For instance, the shipbuilding plants on the lakes are well equipped with machinery, have experienced staffs, and are advantageously placed for raw materials: a deep waterway would allow them to compete in the construction of ocean-going craft.
	And besides all this, present conditions on Lake Ontario and in the lower river would be improved:	Because the proper regulating of both the levels of Lake Ontario and the flow of the river would, of course, be parts of the scheme; the first would be of benefit to the lake harbors and riparian interests, and regulating the river flow would improve both high and low water conditions in Montreal harbor and the river generally. Besides this, a deep waterway would allow deep draft lake vessels to get to Montreal instead of being stopped at the foot of Lake Erie, as at present.
AS TO POWER	The project would provide plenty of power:	It would provide abundant hydro-electric power, and thus eliminate the possibility of power shortages always present in those territories depending on coal because of possible mining stoppages, railroad strikes, freight congestions, etc.
	At a cheap rate:	The power so developed could be supplied at a much cheaper rate than would otherwise be possible.
	In large blocks:	And it could be supplied in large blocks, a necessity for certain classes of industry.
	And very reliable:	The St. Lawrence River in its natural state is an exceptional power proposition in that neither its maximum nor its minimum flow varies more than about 25 per cent. from its average. Under good regulation, which would, of course, be part of any development scheme, conditions would be even better.
	All of which would encourage increased manufacturing:	The foregoing combination of abundant power, at a cheap rate, in large blocks, would encourage and develop general industry, particularly those manufacturing processes in which power plays a large part, such as pulp and paper making, electro-chemistry, electro-metallurgy, etc.
	And be of great general help:	Cheap and abundant power would also improve general living conditions and transportation facilities.
AS TO THE FUEL SITUATION	The project would conserve coal:	The hydro-electric power provided by the development would displace and save large quantities of coal every year, a conservation movement of the best possible type, besides tending, as far as Canada is concerned, to make that country less dependent on foreign supplies.
	Proportionately release labor and capital for other work:	Besides this saving and conservation of the coal itself, the labor at present employed in mining it would be released for other work, together with a proportionate amount of capital now invested in machinery and equipment.
	And reduce the coal load on the railroads:	Furthermore, the railroads would be relieved of the work of transporting the coal so saved, and thus a considerable part of their equipment would be released for other and more valuable traffic. This condition would be particularly marked in the cases of those roads, probably many in number and large in mileage, which decide to electrify their haulage systems, and which would consequently be relieved of the heavy burden of transporting large amounts of non-paying company coal.
GENERAL	If some new route or routes must be found somewhere, a joint scheme would surely be better than individual developments:	It is true that the United States absolutely must have some such waterway, and in the very near future. It is argued that it would be much to the advantage of both countries to have a joint development of the St. Lawrence rather than to have the United States build a canal through its own territory only. Such a route would forever be a serious competitor of the St. Lawrence; not only to hamper further traffic increases, but also to materially lessen even that traffic now existing. This would be a heavy blow to Montreal and Quebec, especially with regard to the grain trade.
	In short:	The question is most serious and important; some improvement is imperatively and urgently needed. The route advocated is the natural and logical one, easily and cheaply to be developed, and an undertaking that will greatly benefit both navigation and power.
	Besides all this it would be a desirable partnership:	Because such a mutual and partnership development would tend to cement and continue friendly relations and closer co-operation between the United States and the British Empire.
	And in the end, power will pay:	Because the cost of the whole project, capital, operation, maintenance, depreciation obsolescence, can be met by the returns from the sale of power.

APPENDIX V

OUTLINE CHART OF THE CLAIMS AND ARGUMENTS ADVANCED BY THE OPPONENTS OF THE ST. LAWRENCE PROJECT

IT IS NOT A GENUINE NAVIGATION DEVELOPMENT AT ALL:		The whole proposition is really nothing but a huge power scheme disguised as a navigation project; and, even its promoters do not seriously believe that the navigation part will ever amount to anything worth while, at least, as far as ocean-going inland traffic is concerned.
AS A NAVIGATION PROJECT IT IS AN ECONOMIC FALLACY, FROM THE PHYSICAL SIDE:	Because the regular ocean boat cannot go into an inland waterway and earn in competition with inland boats, due to:	Its greater capital and operating cost, ton for ton, because it has to be built more strongly and, consequently, more heavily than the inland type. Its reduced freight capacity per gross ton. Its carrying more of a crew, ton for ton, and that crew objecting to navigating inland waters. Its not handling so readily, in consequence of which it must be run at reduced speed in all confined or congested waters; this, and the foregoing, tending to increase both its fixed charges and its operating expenses, and, consequently, the freight rates it must charge.
	The alternative, a combination boat would not be satisfactory:	The alternative, a special boat combining, as far as possible, the best features of the lake freighters with the requisite staunchness of the ocean carrier, would be more costly than the regular ocean type, and so would not be able to compete for trade even on this route, let alone on any other.
IT IS AN ECONOMIC FALLACY FROM THE COMMERCIAL SIDE ALSO, BECAUSE:	The route would be long and tortuous:	The extra distances involved, and the contractions and turnings of the channel, would each and all make the route an expensive one to navigate, both in time and money.
	Insurance rates would be high:	Present insurance rates on the lower St. Lawrence are higher than to Atlantic ports, partly because of the route being largely in restricted channels, partly because of the fogs and the ice encountered in the Gulf, the same handicap would apply to the route when extended.
	There would be no return cargoes:	Besides all the above, the route would be subject to the further heavy handicap of very limited return or inbound cargoes, necessitating a high rate on outbound freight.
	The navigation season would be limited:	Even should the above difficulties be eliminated or overcome, the route would still be closed for five winter months in every year, in itself an almost insurmountable commercial handicap.
	Moreover, there is neither trade to be handled:	The export grain trade of the U.S. is at present on the decline, and not long hence it will entirely disappear. This would relieve the railroads of the export grain movement and automatically lessen the annual autumn freight congestion; this, in turn, eliminating the necessity for increased transportation facilities.
	Nor harbor nor handling facilities therefor:	Further, even if the grain trade persist, there are no proper inland terminal facilities for handling either it or other water-borne ocean freight, and the cost of providing properly equipped terminals, and the necessary deepening of the upper lake harbors and connecting channels, would be enormous, far exceeding the cost of improving the St. Lawrence proper.
BESIDES ALL THE ABOVE IT IS UNDESIRABLE FOR MANY OTHER REASONS, VIZ:	Because it is a foreign route:	In both Canada and the States, but particularly the latter, it is said that the proposition is of foreign origin, is for the benefit of a foreign country, and involves the expenditure of U.S. national funds in foreign territory.
	Because other and home routes are better:	In the States it is said that the New York State Barge Canal is substantially ready and able to handle the traffic, and that it should be given a trial before the St. Lawrence project is embarked upon. Then if it should prove inadequate, other domestic water routes, such as Lake Ontario to the Hudson and Lake Erie to the Mississippi, and the possibility of additional rail facilities, should all be further investigated before the St. Lawrence project is definitely undertaken. In Canada it is said that the completion of the Hudson Bay Railway, and the building of the Georgian Bay Canal, are the enterprises that should receive first attention when the country can afford to undertake any further responsibilities.
	Because it would injure present port development and trade:	Moreover, the State of New York, and the coast cities of the eastern States, like Baltimore, Philadelphia, New York, Boston, etc., and the Canadian ports of Quebec and Montreal, state that they have provided extensive port and other facilities, adequate for all the business offering, and that the St. Lawrence route would divert their trade and unfairly impair the value of their investments.
	Because the power arguments are not sound:	There is plenty of other hydro-electric power either immediately available or else easily and cheaply to be developed without touching the St. Lawrence for years to come, especially as far as Canada is concerned. Further, if any of the Canadian share of the St. Lawrence power were exported it would be very difficult to ever withdraw it for home use, no matter how badly it might be needed. Moreover, Governmental development of and trading in power is undesirable, private company operation being much more efficient. Besides, it is claimed both in the States and Canada that the power rights and all returns therefrom are the property of the state or of the province, as the case may be, and therefore cannot under any pretext whatever be applied towards carrying a responsibility of the two Federal Governments, which a navigation project would be. In any case, it has yet to be shown that there is a market for the power.
	Because financial conditions are not propitious; the cost is much underestimated, and the project has not received sufficient study:	In both countries, but especially in Canada, it is said that present financial conditions are such that it would be entirely improper to embark yet awhile on any such enterprise, even assuming that it were economically sound, and all other objections had been met. Further, the proposition is not feasible from an engineering point of view, insufficient time has been allowed for investigation and the preparation of estimates, and the cost figures now being quoted will later on be found to be very far below the expenditure actually required.
	Because, in addition to all the above:	Deep water canalization would be objectionable because it would permit large naval vessels to reach the Great Lakes, and thus expose the lakes cities of both countries to naval attack. Internationalization of the St. Lawrence would be objectionable, from the British and Canadian standpoints, because it would tend to give another nation certain interests and rights in waters now under exclusively Canadian control.

FINALLY, it is said that the proposed development is really not needed at all, because the power when wanted can be developed in the usual way; and, as far as transportation is concerned, any present difficulties are entirely abnormal, the result of the war, and will remedy themselves if given reasonable time for readjustment.

ACKNOWLEDGEMENTS

The author desires to place on record his grateful appreciation of the courteous assistance received in the preparation of this volume. Among the many whose help has been so invaluable in the correction of material; in the submission of new facts, and in the granting of permission to make use of copyright material, he desires to name the following without, however, in any way implying their agreement or dissent with any views expressed. For such expressions of any definite standpoint on controversial matters the author alone is responsible.

To the following ladies, gentlemen, firms, corporations and Government Departments, therefore, the author's thanks are here publicly expressed:

In Canada—

F. A. Acland, King's Printer, Ottawa.
The Bell Telephone Company of Canada, Montreal.
Mrs. F. S. Bell, Montreal.
Lawrence A. Burpee, Secretary, International Joint Commission, Ottawa.
Canada Steamship Lines, Ltd., Montreal.
Canadian Hydro-Electric Corporation, Ltd., Ottawa.
Canadian Review Company, Ltd., Toronto.
R. H. Coats, F.R.S.C., F.S.S. (Hon.), Dominion Statistician and Controller of the Census, Ottawa.
W. Coolican, Assistant Deputy Postmaster General, Ottawa.
L. V. de Bury, Canada Steamship Lines, Ltd., Montreal.
P. B. de Crèvecoeur, and Staff of the Fraser Institute, Montreal.
A. G. Doughty, C.M.G., LL.D., Deputy Minister Public Archives of Canada, Ottawa.
McNeely DuBose, General Superintendent, Duke-Price Power Company, Ltd., Arvida, P.Q.
Colonel A. E. Dubuc, M.E.I.C., Chief Engineer, Department of Railways and Canals, Ottawa.

Duke-Price Power Company, Ltd., Montreal.
W. H. Duthie, Canada Steamship Lines, Ltd., Montreal.
Ashley Edwards, Department of Immigration and Colonization, Canadian Pacific Railway Company, Montreal.
W. Stuart Edwards, Deputy Minister of Justice, Ottawa.
Wesley Frost, United States Consul General, Montreal.
G. Gordon Gale, M.Sc., A.M.I.E.E., M.E.I.C., Vice-President, Canadian Hydro-Electric Corporation, Ltd., Ottawa.
Gatineau Power Company, Ottawa.
W. S. Hart, Vice-President, The Shawinigan Water & Power Company, Montreal.
L. C. Haskell, Secretary, Southern Canada Power Company, Ltd., and Northern Quebec Power Company, Ltd., Montreal.
W. H. Hobbs, Canadian National Railways, Montreal.
Rupert D. Holland, Oswald & Drinkwater, Montreal.
Mrs. Castell Hopkins, The Canadian Review Company, Ltd., Toronto.
The Hydro-Electric Power Commission of Ontario, Toronto.
International Joint Commission, Ottawa.
Fred James, Assistant Director of Publicity, Department of Immigration and Colonization, Ottawa.
Alexander Johnston, Deputy Minister, Department of Marine and Fisheries, Ottawa.
J. T. Johnston, C.E., M.E.I.C., Dominion Water Power and Reclamation Service, Department of the Interior, Ottawa.
Professor Stephen Leacock, B.A., Ph.D., F.R.S.C., Litt.D., LL.D., McGill University, Montreal.
Gerhard R. Lomer, M.A., Ph.D., and Staff of the McGill University Library, Montreal.
F. C. C. Lynch, Director, Natural Resources Intelligence Service, Department of the Interior, Ottawa.
W. R. MacInnes, Vice-President, Canadian Pacific Railway Company, Montreal.
P. A. McFarlane, The Bell Telephone Company of Canada, Montreal.
Mechanics Institute of Montreal.
V. Meek, Acting Director of Water Power and Reclamation Service, Department of the Interior, Ottawa.
V. E. Mitchell, K.C., Montreal.
Montreal Light, Heat & Power, Consolidated, Montreal.
Wilson Muir, Nesbitt, Thomson & Co., Ltd., Montreal.
Natural Resources Intelligence Service, Department of the Interior, Ottawa.

Nesbitt, Thomson & Company, Ltd., Montreal.
L. Normandin, Chief, Division of Documents, Department of Public Printing and Stationery, Ottawa.
J. S. Norris, Vice-President and Managing Director, Montreal Light, Heat & Power, Consolidated, Montreal.
Northern Quebec Power Company, Ltd., Montreal.
Colonel E. W. Pope, Montreal.
Lady Joseph Pope, Ottawa.
Price Bros. & Company, Ltd., Quebec.
Lieut.-Colonel John H. Price, Price Bros. & Company, Ltd., Quebec.
Thomas L. Richard, Commissioner of Patents, Ottawa.
L. V. Rorke, Deputy Minister, Department of Surveys, Toronto.
Shawinigan Water & Power Company, Montreal.
Adam Shortt, C.M.G., LL.D., F.R.S.C., Ottawa.
O. D. Skelton, Ph.D., Under-Secretary of State for External Affairs, Ottawa.
William A. Smale, United States Consul, Montreal.
William Smith, Public Archives of Canada, Ottawa.
Southern Canada Power Company, Ltd., Montreal.
Professor Lesslie R. Thomson, M.E.I.C., McGill University, Montreal.
P. A. Thomson, Nesbitt, Thomson & Company, Ltd., Montreal.
Rielle Thomson, Beauharnois Light, Heat & Power Company, Montreal.
Laurence Chalmers Tombs, M.A., Montreal.
W. A. Warne, External Trade Branch, Dominion Bureau of Statistics, Ottawa.
Arthur V. White, Consulting Engineer, Hydro-Electric Power Commission of Ontario, Toronto.
John Williamson, Presbyterian College Library, Montreal.
G. S. Wrong, Transportation Branch, Dominion Bureau of Statistics, Ottawa.

In England—
Edward Arnold & Company, London.
Macmillan & Company, Ltd., London.
C. W. Whitaker, London.

In the United States of America—
William M. Acheson, Chief Engineer, State of New York, Department of Public Works, Albany, N.Y.
The Americana Corporation, New York.
Arthur H. Brook, Glasgow, Brook & Company, New York.

W. M. Carpenter, Research Statistician, National Electric Light Association, New York.

L. D. Cornish, Chief Engineer, State of Illinois, Department of Purchases and Construction, Division of Waterways, Chicago.

Charles P. Craig, Executive Director, Great Lakes-St. Lawrence Tidewater Association, Washington.

Department of Conservation, State of Michigan.

Isaac DeYoung, War Department, United States Engineer Office, Sault Ste. Marie, Mich.

Division of Engineering, Department of Public Works, State of New York.

The Encyclopaedia Britannica, Incorporated, New York.

Lewis B. Ermeling, Executive Secretary, National Association of Building Owners and Managers, Chicago.

Edwin R. Havens, Division of Lands, Department of Conservation, Lansing, Mich.

F. D. Hull, The Encyclopaedia Britannica, Incorporated, New York.

The Macmillan Company, New York.

A. H. McDannald, The Americana Corporation, New York.

Charles J. McManus, Great Lakes-St. Lawrence Tidewater Association, Washington.

Paul Morgan Ogilvie, M.A., Washington.

Lieut.-Colonel Thomas M. Robins, War Department, Office of the Chief of Engineers, Washington.

George Otis Smith, M.A., LL.D., Ph.D., Director, United States Geological Survey, Washington.

William H. Smith, Secretary, International Joint Commission, Washington.

Alton P. Tisdel, Superintendent of Documents, United States Government Printing Office, Washington.

BIBLIOGRAPHY

Almanack For the Year of Our Lord 1929. By Joseph Whitaker, F.S.A. London, 12 Warwick Lane, Paternoster Row.

American Commonwealth. By James Bryce. London, Macmillan & Co., 1888, 2 vols.

American Year Book: A Record of Events and Progress, Year 1928. Editor, Albert Bushnell Hart, LL.D. Associate Editor, William M. Schuyler. Edited with the co-operation of a Supervisory Board representing National Learned Societies. New York, The American Year Book Corporation, 229 West 43rd Street, 1929.

Annual Report of the Department of Railways and Canals for the Fiscal Year from April 1, 1927, to March 31, 1928. Ottawa, F. A. Acland, Printer to the King's Most Excellent Majesty, 1929.

Annual Report of the Governor of the Panama Canal for the Fiscal Year ended June 30, 1928. United States Government Printing Office, Washington, 1928.

Annual Reports, War Department, Fiscal Year ended June 30, 1928. Report of the Chief of Engineers U.S. Army to the Secretary of War, 1928. United States Government Printing Office, Washington, 1928.

Canada and Its Provinces, A History of the Canadian People and their Institutions by One Hundred Associates. Adam Shortt, Arthur G. Doughty, General Editors. Printed by T. & A. Constable at the Edinburgh University Press for the Publishers' Association of Canada, Ltd. Toronto, 1917.

Canada Year Book, 1927-28, The Official Statistical Annual of the Resources, History, Institutions and Social and Economic Conditions of the Dominion. Published by Authority of Hon. James Malcolm, M.P., Minister of Trade and Commerce. Ottawa, F. A. Acland, Printer to the King's Most Excellent Majesty, 1928.

Canadian Annual Review of Public Affairs, (Founded by J. Castell Hopkins) Vols. 1919 to 1927-28. Toronto, The Canadian Review Co., Ltd.

Canadian Hydro-Electric Corporation, Ltd., Controlling Gatineau Power Company, Gatineau Electric Light Company, Ltd., Saint John River Power Company. First Annual Report, December 31, 1928. Executive and General Offices, Ottawa.

Canadian View of the St. Lawrence Project, Being a Series of Seven Articles published in The Toronto Daily Star in the month of December, 1927. The Star Printing & Publishing Co., Ltd., Toronto.

Census of Electrical Industries, 1927. Electric Light and Power Plants in the United States. Department of Commerce, Washington, March 30, 1929.

Census of Industry, 1926, Part 1—Statistics. Central Electric Stations in Canada. Department of Trade and Commerce, Dominion Bureau of Statistics. Ottawa, F. A. Acland, Printer to the King's Most Excellent Majesty, 1928.

Chicago Drainage Canal. Précis of Documents and Proceedings Prepared for the use of the Senate in accordance with the request of Hon. W. B. Ross. Department of External Affairs, Ottawa, April, 1928.

Collection of all the Treaties of Peace, Alliance, and Commerce, Between Great-Britain and other Powers, From the Treaty signed at Munster in 1648, to the Treaties signed at Paris in 1783. To which is prefixed, A Discourse on the Conduct of the Government of Great-Britain in respect to Neutral Nations. By the Right Hon. Charles Jenkinson. London: Printed for J. Debrett, Opposite Burlington House, Piccadilly, 1785. 3 vols.

Collection of Treaties Between Great Britain and Other Powers. By George Chalmers, Esq. London, Printed for John Stockdale, Piccadilly, 1790. 2 vols.

Concise View of the Inland Navigation of the Canadian Provinces; The Improvements Already Effected and the Inferences to be drawn from these, towards their Full Practicable Accomplishment, and Practical Value, By A. Projector. St. Catharines, U.C., Printed at the Welland Canal Intelligence Office, 1832. (Public Archives of Canada)

Constitutional Law of the United States of America. By Dr. H. von Holst, Privy Councilor and Professor in the University of Freiburg. Authorized Edition. Translated by Alfred Bishop Mason. Chicago, Ill.: Callaghan & Co., 1887.

Construction Work by Governor Len Small, State of Illinois Department of Purchases and Construction. Report to Governor Len Small. *Division of Waterways,* by William F. Mulvihill, Supervisor of Illinois Waterway Construction. Chicago.

Convention and Protocol between Canada and the United States regarding the Niagara Falls and the Niagara River. Signed at Ottawa, January 2, 1929. Ottawa, F. A. Acland, Printer to the King's Most Excellent Majesty, 1929.

Developed and Potential Water Power in the United States. Department of the Interior, Geological Survey, No. 20804, February 11, 1928.

Developed and Potential Water Power of the World at the end of 1926. Washington, Department of the Interior, P.N. 19425, December 19, 1927.

Developed Water Power in the United States, January 1, 1929. United States, Department of the Interior, Geological Survey, Washington, No. 29839, February 8, 1929.

Documents Illustrative of the Canadian Constitution. Edited with Notes and Appendixes. By William Houston, M.A., Librarian to the Ontario Legislature. Toronto: Carswell & Co., Law Publishers, 1891.

Documents of the Canadian Constitution, 1759-1915, selected and edited by W. P. M. Kennedy, M.A. Toronto, Oxford University Press, 1918.

Documents Relating to the Constitutional History of Canada, 1759-1791. Selected and Edited with Notes by Adam Shortt and Arthur G. Doughty. Second and Revised Edition by the Historical Documents Publication Board. Ottawa, Printed by J. de L. Taché, Printer to the King's Most Excellent Majesty, 1918, 2 vols.

Electric Light and Power Industry in the United States, With Chapters on the Electric Railway and Gas Industries, and an Up-to-Date Bibliography of Public Utility References. Revised to July 1, 1928. Published by the National Electric Light Association, New York.

Empire in the New Era, Speeches delivered during an Empire tour, 1927-1928, by the Rt. Hon. L. S. Amery, M.P., with a Foreword by the Rt. Hon. the Earl of Balfour, K.G., O.M. London, Edward Arnold & Co., 1928.

Encyclopedia Americana, A Library of Universal Knowledge. The Americana Corporation, New York, Chicago, 1925.

Encyclopaedia Britannica, A Dictionary of Arts, Sciences, Literature, and General Information. Thirteenth Edition. London, The Encyclopaedia Britannica Co., Ltd. New York, The Encyclopaedia Britannica, Inc.

Feudal Canada: The Story of the Seigniories of New France. By Thomas Guerin. Montreal, 1926.

Great Lakes and St. Lawrence River: An International Highway to the Sea. Observations upon the Reciprocal Rights and Duties of Canada and the United States, respecting the Navigation and Development of the Great Lakes-St. Lawrence Seaway. Great Lakes-St. Lawrence Tidewater Association, 521-523 Munsey Building, Washington. Bulletin No. 36, August, 1927.

History of Nova-Scotia, or Acadie, by Beamish Murdoch, Esq., Q.C. Halifax, N.S. James Barnes, Printer and Publisher, 1865.

Hydro-Electric Power Commission of Ontario, Its Origin, Administration and Achievements. Executive and General Offices, Toronto.

Illinois Waterways: A Guide for Navigators from Lake Michigan to the Mississippi River via the Chicago Sanitary District Canal, the Illinois and Michigan Canal and the Illinois River. Also an Alternative Route via the Illinois and Mississippi (Hennepin) Canal. Fifth Edition. State of Illinois, Department of Purchases and Construction, Division of Waterways, Chicago. Bulletin No. 10, May 1, 1928.

International Waterways: I. The Evolution of the Principle of International Waterways, II. A Reference-Manual to the Treaties, Conventions, Laws, and other Fundamental Acts Governing the International Use of Inland Waterways. By Paul Morgan Ogilvie, M.A. New York, The Macmillan Co., 1920.

In the Supreme Court of the United States. October Term, 1927. Report of the Special Master. (re Sanitary District of Chicago)

In the Supreme Court of the United States. October Term, A.D. 1927. Brief for Defendants, Illinois and the Sanitary District of Chicago.

Jay's Treaty, A Study in Commerce and Diplomacy. By Samuel Flagg Bemis, Ph.D., Professor of History, Whitman College. New York, The Macmillan Co., 1923.

Letter to the Earl of Shelburne, by "Portius." London: Printed by J. Debrett, Opposite Burlington House, Piccadilly, 1783. (Public Archives of Canada)

List of Water Powers in the Province of Ontario. By L. V. Rorke, Director of Surveys and Chief Engineer in co-operation with the Dominion Water Power and Reclamation Service, Department of the Interior, Ottawa. Toronto, Printed and Published by Clarkson W. James, Printer to the King's Most Excellent Majesty, 1925.

Memoirs of the Right Honourable Sir John Alexander Macdonald, G.C.B., First Prime Minister of the Dominion of Canada. By Joseph Pope. Ottawa, J. Durie & Son, 2 vols.

Most Gigantic Engineering Blunder in America, Address by William George Bruce, President, Great Lakes Harbors Association. *Legal Aspects of the Case.* Address by Hon. Herman L. Ekern, Attorney General for Wisconsin. *Nutshell Findings and Conclusions,* by Hon. Daniel W. Hoan, Mayor of Milwaukee, Wisconsin. *Protest, Preamble and Resolutions* Adopted at Cleveland, Ohio, January 15-16, 1925, by The Great Lakes Harbors Association (American and Canadian).

National Problems of Canada: *The Port of Montreal,* by Laurence Chalmers Tombs, M.A. McGill University Economic Studies, No. 6. Published at St. Martin's House, Toronto, by The Macmillan Company of Canada, Ltd., for the Department of Economics and Political Science, McGill University, Montreal.

New York State Canal System: *Description of Routes and Structures,* by Frederick Stuart Green, Superintendent of Public Works and Thomas F. Farrell, Commissioner of Canals and Waterways. Issued by the Division of Canals and Waterways, State Department of Public Works, 353 Broadway, Albany, N.Y., 1928.

Observations upon the Treaty of Washington signed, August 9, 1842, with the Treaty annexed. Together with a map, to illustrate the Boundary Line as established by the Treaty Between Her Majesty's Colonies of New Brunswick and Canada and the United States of America. By George William Featherstonhaugh Esq., F.R.S., F.G.S., Late one of Her Majesty's Commissioners for the North American Boundary. London: John W. Parker, West Strand, 1843. (Public Archives of Canada)

Palgrave's Dictionary of Political Economy. Edited by Henry Higgs, C.B. Macmillan & Co., Ltd., St. Martin's Street, London, 1926.

Power Capacity and Production in the United States. Papers by C. R. Daugherty, A. H. Horton and R. W. Davenport. Water-Supply Paper 579. U. S. Geological Survey, Department of the Interior. United States Government Printing Office, Washington, 1928.

Power Development on the Niagara River. Power Plants of the Hydro-Electric Power Commission of Ontario. Executive and General Offices, Toronto.

Preliminary Report of the Inland Waterways Commission: *Message from the President of the United States, Transmitting a Preliminary Report of the Inland Waterways Commission.* 60th Congress, 1st Session, Senate, Document No. 325. Washington, Government Printing Office, 1908.

Proceedings of the Special Committee appointed to inquire into the Development and Improvement of the St. Lawrence River, with Prefatory Digest of the Evidence and Documents fyled. The Hon. C. E. Tanner, Chairman. Ottawa, F. A. Acland, Printer to the King's Most Excellent Majesty, 1928.

Production of Electric Power by Public Utility Power Plants in the United States in 1927. Compiled by Division of Power Resources. United States, Department of the Interior, Geological Survey, Washington. No. 22659, April 16, 1928.

Ditto in 1928. No. 32285, May 27, 1929.

Report of Joint Board of Engineers on St. Lawrence Waterway Project, Dated November 16, 1926. Ottawa, F. A. Acland, Printer to the King's Most Excellent Majesty, 1927.

Saint Marys Falls Canal: Exercises at the Semi-Centennial Celebration at Sault Sainte Marie, Michigan, August 2 and 3, 1905; together with a History of the Canal by John H. Goff, and Papers relating to the Great Lakes. Edited and Compiled by Charles Moore. Detroit, Michigan, Published by the Semi-Centennial Commission, 1907.

St. Marys Falls Canal, Michigan, Statistical Report of Lake Commerce Passing through Canals at Sault Ste. Marie, Michigan and Ontario during Season of 1928 with Supplementary Report of Commerce passing through the Detroit River. Prepared under direction of Major D. McCoach, Jr., Corps of Engineers, U. S. Army. United States Government Printing Office, Washington, 1929.

St. Lawrence Problem, Some Canadian Economic Aspects. By Lesslie R. Thomson, M.E.I.C., Consulting Engineer, Montreal. Paper presented before the Annual General and General Professional Meeting of the Engineering Institute of Canada, Hamilton, Ont., February 14, 1929. Reprinted from *The Engineering Journal,* April, 1929. The Engineering Institute of Canada, 2050 Mansfield Street, Montreal.

St. Lawrence Waterway: Message from the President of the United States Transmitting a Letter from the Secretary of State Submitting the Report of the International Joint Commission concerning the Improvement of the St. Lawrence River between Montreal and Lake Ontario for Navigation and Power. 67th Congress, 2nd Session, Senate, Document No. 114. Washington, Government Printing Office, 1922.

St. Lawrence Waterway Project: 1. Correspondence between the Governments of Canada and the United States, 1927-28. 2. Report of the Canadian National Advisory Committee, January, 1928, and observations thereupon by certain of its members. 3. Orders in Council referring to the Supreme Court of Canada certain questions as to water power rights of the Dominion and the Provinces. Ottawa, F. A. Acland, Printer to the King's Most Excellent Majesty, 1928.

St. Lawrence Waterway Project: Message from the President of the United States transmitting a Report of the Chairman of the United States St. Lawrence Commission upon the Development of Shipway from the Great Lakes to the Sea. 69th Congress, 2nd Session, Senate, Document No. 183. United States Government Printing Office, Washington, 1927.

Shawinigan Water and Power Company, Annual Report, 1928.

Short History of the Canadian People, by George Bryce, M.A., D.D., LL.D. New and revised edition, Toronto, The Ryerson Press.

Sketches of Celebrated Canadians, and Persons Connected with Canada, From the Earliest Period in the History of the Province down to the Present Time. By Henry J. Morgan. Quebec: Printed and Published by Hunter, Rose & Co., 1862.

Some Objections to the United States Proposals for the St. Lawrence Waterway. Royal Securities Corporation, Ltd., Montreal, September, 1927.

Statistical Abstract of the United States, 1928. Department of Commerce, Bureau of Foreign and Domestic Commerce, Fiftieth Number. United States Government Printing Office, Washington, 1928.

Statistical Data for the Electric Light and Power Industry, 1928. Statistical Bulletin No. 3. June, 1929. National Electric Light Association, 420 Lexington Avenue, New York City. Publication No. 289-81.

Supreme Court of the United States. Nos. 7, 11, and 12 Original.— October Term, 1928. (re Sanitary District of Chicago)

Transportation Economics of the Great Lakes-St. Lawrence Ship Channel, by Alfred H. Ritter. Published by the Great Lakes-St. Lawrence Tidewater Association, Washington, November, 1925.

Treaties and Agreements Affecting Canada in Force between His Majesty and the United States of America with Subsidiary Documents, 1814-1925. Compiled in the Department of External Affairs. Ottawa, F. A. Acland, Printer to the King's Most Excellent Majesty, 1927.

Treaties between His Most Chirstian Majesty and the Thirteen United States of America, Printed by order of Congress, Philadelphia. London: Reprinted for J. Stockdale, opposite Burlington House, Piccadilly, 1783. (Public Archives of Canada)

Treaty of Peace and Friendship Between the most Serene and most Potent Princess *Anne,* by the Grace of God, Queen of *Great Britain, France,* and *Ireland,* and the most Serene and most Potent Prince *Lewis* the XIVth, the most Christian King, Concluded at *Utrecht* the 21/11 Day of March/April 1713. By Her Majesties Special Command. London, Printed by *John Baskett,* Printer to the Queens Most Excellent Majesty, And by the Assigns of *Thomas Newcomb,* and *Henry Hills,* deceas'd. 1713.

War Department, Corps of Engineers, Bulletin No. 38, Survey of Northern and Northwestern Lakes. U. S. Lake Survey Office, Detroit, Mich., April, 1929. U. S. Government Printing Office, 1929.

Water Power Resources of Canada. Dominion Water Power and Reclamation Service, Department of the Interior, Ottawa. Bulletin No. 1253, January 15, 1929.

Water Resources Paper No. 55. Central Electric Stations in Canada. Part II-Directory (May 1, 1928). By Alexander Roger, O.L.S., D.L.S., Engineer, Dominion Water Power and Reclamation Service. Prepared in collaboration with the Dominion Bureau of Statistics of the Department of Trade and Commerce. Ottawa, F. A. Acland, Printer to the King's Most Excellent Majesty, 1929.

Magazines and Newspapers.

Atlantic Monthly, The The Atlantic Monthly Co., Concord, N.H.

Canadian Historical Review, New Series of the Review of Historical Publications Relating to Canada. Published Quarterly At the University of Toronto Press. March, 1926, and September, 1928.

Citizen, The Ottawa.

Dalhousie Review, Review Publishing Co., Ltd., Halifax, N.S. January, 1929.

Gazette, The Montreal.

Globe, The Toronto.

Journal of the Canadian Bankers' Association, Canadian Bankers' Association, Toronto, January, 1929.

Manitoba Free Press.

Montreal Daily Star, The.

Ottawa Morning Journal, The.

Royal Colonial Institute Journal, The Royal Colonial Institute, Northumberland Avenue, London, W.C. 2, October, 1911.

Saskatoon Star-Phoenix, The.

Saturday Night, Toronto.

Toronto Daily Star, The.

INDEX OF NAMES

Acworth, William M., 60, 61.
Adams, John, 28.
Adams, John Quincy, 31.
Adams, William, 31.
Adams, W. H., 161.
Ahearn, Thomas, 212.
Aitkin, Sir Max, 351.
Albrecht, Emil P., 175.
Alger, Russell A., 313.
Allen, H. J., 200.
Allen, Ira, 282.
Almy, John, 291.
Amery, Right Hon. L. S., 54.
Ashburton, Lord, 32.
Astor, John Jacob, 35.
Atherton, Charles, 142.
Aylmer, Lord, 140, 141.

Baker, Newton D., 313.
Ballantyne, Hon. C. C., 166.
Baring, Alexander, (see Ashburton, Lord).
Barnes, Julius H., 176.
Barrett, Alfred, 152, 153.
Bayard, James A., 31.
Bayfield, Captain, 140.
Beaudry, Laurent, 232.
Beauharnois, Charles, Marquis de, 350.
Beaverbrook, Lord, (see Aitkin, Sir Max).
Beck, Sir Adam, 161, 163, 174, 182, 201, 202, 206, 207, 208, 343.
Bedford, Earl of, 23.
Beecher, Henry Ward, 355.
Bégon, Michel, 254.
Beique, Hon. F. L., 235.
Belcourt, Hon. N. A., 235.
Benson, Admiral W. S., 176.
Bernard, Mountague, 42.
Biggar, Colonel, 213.
Bingham, John, 172.
Blain, Hugh, 184.
Bonaparte, Napoleon, 89.
Borden, Right Hon. Sir Robert L., 182.
Bowden, W. A., 180.
Bowden, W. S., 161.
Brazil, Emperor of, 42.
Breed, William C., 211.
Breithaupt, W. C., 161.
Brooks, Maria, 95.
Brown, F. B., 353.
Brown, G. W., 21.
Brown, J. L., 203.
Bruce, William C., 223, 310.
Brunelle, Pierre, 67.
Bryce, Right Hon. James, 45, 47, 361.
Burgoyne, W. B., 161.
Burnett, Thomas, 261.
Bute, Lord, 21.
By, Lieut.-Col. John, 279, 280.

Cahill, F. S., 203.
Calder, R. L., 246.
Calder, W. W., 192, 194.
Cameron, K. M., 213.
Campbell, J. M., 170.
Carleton, Thomas, 20.
Carpenter, Judge, 314, 315.
Cartier, Jacques, 96.
Casgrain, Hon. J. P. B., 203, 204, 235.

Cauchon, Noulan, 172.
Chalmers, W. W., 183, 184, 192.
Champlain, Samuel, 96, 327.
Chapleau, S. J., 272.
Chaptal, 321.
Charlemagne, 88.
Charles, Archduke, 19.
Charles III, King of Spain, 22.
Charles V, King of Spain, Emperor of Germany, 89.
Charles the Great, (see Charlemagne).
Chaussegros de Léry, Gaspard, 254.
Church, T. L., 163, 175, 202, 203.
Clark, Clarence D., 160.
Clark, T. C., 327, 328.
Clark, William, 35, 36.
Clay, Henry, 31, 293.
Clinton, George, 156.
Clowes, Samuel, 266, 279.
Cockshutt, Colonel W. F., 223.
Colden, Cadwallader, 287.
Coles, Arthur A., 170.
Connolly, U. S., 181.
Cook, Captain James, 36.
Cooke, Hon. J. R., 213, 344.
Coolidge, President, 208.
Copeland, Senator, 245.
Coppley, C. G., 184.
Cornwall, Barry, 333.
Coste, Louis, 156.
Cousins, E. L., 161, 175, 329.
Coutlee, C. R., 213.
Craig, C. P., 161, 162.
Cunard, Samuel, 63.

Daly, Secretary, 141.
Dane, Barry, 393.
Davidson, James E., 211.
Deacon, T. R., 172.
Deane, Silas, 281.
de Grey, Lord, (see Ripon, Earl).
Dempsey, Hon. Stephen W., 168, 330, 331.
DeYoung, Isaac, 296.
Dollier de Casson, Francis, 254.
Dorchester, Lord, 281.
Drayton, Sir Henry L., 60, 61.
Drury, Hon. E. C., 207.
Dubuc, Colonel A. E., 62.
Dunning, Hon. Charles, 236.
Durand, Sir Mortimer, 159.
Durham, Earl of, 256, 265.

Elgin, Lord, 38.
Elliott, Hon. J. C., 272.
Ernst, Colonel O. H., 156.

Farrell, Thomas F., 302, 324.
Ferguson, Hon. G. Howard, 213, 214, 233, 236, 237.
Finch, Roy G., 214, 215.
Finley, J. H., 169.
Fish, Hamilton, 42.
Fleming, O. E., 161, 163, 176, 177.
Forneret, V. W., 213.
Foster, Sir George, 390.
Foster, Hon. W. E., 212.
France, King of, (see also Louis XIV, XV) 19, 96.
Franklin, Benjamin, 28.
Frederick the Great, 21.
French, Elsie, 16.
Frewin, Moreton, 192.

Gaby, F. A., 213, 344.
Gallatin, Albert, 31.
Gambier, Lord, 31.
Garden, A. C., 170.
Gardner, Obadiah, 160, 168, 169.
Garrison, Lindley M., 313.

Geddes, Sir Auckland, 194.
George II, 21.
George III, 21, 22, 24, 28, 30.
German, W. M., 161, 163.
Germany, Emperor of, (see also Charles V) 44.
Gibbons, George C., 156.
Gladstone, Right Hon. William Ewart, 38.
Glen, R. B., 160.
Goderich, James P., 211.
Goderich, Viscount, 41.
Goethe, 378.
Goulburn, Henry, 31.
Gourlay, R. S., 170.
Graham, G. A., 161.
Graham, Hon. G. P., 212, 234.
Grantham, Lord, 41.
Granville, Earl, 43.
Gray, Charles F., 172.
Gray, Robert, 34, 35.
Greene, Frederick S., 247, 324.
Gregory, W. D., 170.
Grenville, Lord, 29.
Griffin, A. J., 183.
Grimaldo, Don Jerome, 23.
Guthrie, Hon. Hugh, 159.

Haldimand, Sir Frederick, 257.
Hamilton, Alexander, 74.
Harding, President, 192.
Harding, W. L., 223.
Harriman, H. T., 184.
Hartley, David, 28.
Hastings, Warren, 26.
Hearst, Sir William, 166.
Henderson, George, 242.
Henry, R. A. C., 272.
Herodotus, 87.
Hicks, F. C., 183.
Hill, Henry W., 169.
Hincks, Sir Francis, 21.
Hoar, Ebenezer, R., 42.
Hoar, Hon. George F., 362.
Hocquart, Gilles, 63.
Hogg, T. H., 214, 353.
Hollindrake, T. A., 175.
Homer, 382.
Hoover, Hon. Herbert C., 176, 211, 219, 224, 237, 242, 319.
Howard, J. R., 176, 211.
Howland, Peleg, 239.
Hughes, Charles Evans, 48, 194, 316, 359.
Hughes, H. J., 181.

Italy, King of, 42.

Jadwin, Major-Gen. Edgar, 210.
Jameson, Mrs., 2.
Jay, John, 28, 29.
Jebb, Captain, 278.
Johnston, J. T., 213.
Jones, Frank P., 351.
Jonson, Ben, 392.
Joseph I, King of Portugal, 22.
Jost, E. B., 213.
Justinian, 86.

Keefer, F. H., 161, 163.
Kellog, Hon. Frank B., 219, 220, 221, 232, 233, 244.
Kelly, Colonel William, 210.
Kempt, Sir James, 140.
Kennedy, W. C., 161.
Killaly, H. H., 285.
King, W. F., 156.
King, Right Hon. W. L. Mackenzie, 195, 208, 220, 221, 226, 242, 397, 398.
Knox, Philander C., 47.

Lanctot, Charles, 244.
Landis, Judge, 314, 315.
Lapierre, E. A., 203.
Lapointe, Hon. Ernest, 48, 236.
Larson, O. J., 181.
Leboeuf, Randall Jr., 214.
Lee, W. S., 353.
Lefebvre, O. O., 210.
Leman, Beaudry, 212.
Lenroot, Hon. Irvine L., 177.
Lewis, A. C., 170, 177, 204.
Lewis, Meriwether, 35, 36.
Longfellow, H. W., 95.
Longueuil, Baron de, 257.
Loreburn, Lord, 410.
Louis XIV, 19, 254, 260, 350.
Louis XV, 22.
Lymburner, Adam, 260, 281.
Lynch-Staunton, Hon. G., 235, 239.

Macdonald, Right Hon. Sir John A., 42, 43.
Mackenzie, Alexander, 36.
Maclean, R. J., 162.
Magrath, C. A., 160, 213, 241, 344.
Maguire, C. A., 213.
Mahan, Admiral, 92.
Manion, Hon. R. J., 203.
Mann, Colonel Gother, 258.
Mann, Captain J. F., 277.
Mansfield, Lord Chief Justice, 24.
Marlborough, Duke of, 19.
Marshall, George, 15.
Martin, Edward D., 212.
Mason, Governor, 291.
Massey, Hon. Vincent, 219, 229.
Maybee, James P., 156.
McArthur, Duncan, 241.
McCracken, Tracy, 292.
McDougald, Hon. W. L., 212, 234, 238.
McGinnis, Joseph A., 214.
McGuire, C. Alfred, 344.
McKinley, W. B., 193.
McLachlan, D. W., 210, 272.
McNaughton, Brig.-General A. G. L., 213.
McNaughton, John, 327.
Mello and Castro, Martin de, 23.
Merritt, William H., 39, 269.
Mignault, P. B., 160, 167.
Miller, John, 203.
Miller, Nathan L., 185, 200.
Mills, Lieut.-Colonel D. A., 21.
Mills, John B., 264, 265, 266.
Milner, W. A., 172.
Mitchell, Brig.-General C. H., 210, 211.
Molson, Hon. John, 64.
Monck, Viscount, 41.
Montcalm, Louis Joseph, Marquis de, 21.
Montesquieu, 90.
Moulton, H. G., 296.
Mulvihill, William F., 310, 326.
Murdoch, Beamish, 20.

Nancekivell, F. A., 162.
Napoleon Bonaparte, (see Bonaparte, Napoleon).
Nelson, Admiral Lord, 89.
Nelson, A. P., 183.
Nelson, Samuel, 42.
Netherlands, King of the, 32, 33, 34.
Nicholl, R., 151.
Nicholls, Lieut.-Colonel G., 278.
Noonan, James D., 211.
Northcote, Sir Stafford H., 42.

Ottinger, Albert, 214.
Outerbridge, E. H., 186.

Page, John, 144.
Paish, Sir George, 60.
Paterson, Walter, 20.
Peter, Dominie, 74.
Phillips, Hon. William, 222, 397, 398.
Phillpotts, Lieut.-Colonel George, 256, 262, 263, 265.
Pillsbury, Lieut.-Colonel George B., 210.
Pitt, William, 21, 22.
Polk, President James K., 36.
Pont-Gravé, François Gravé, Sieur de, 63.
Pope, Joseph, 43.
Pope, W. W., 344.
"Portius," 26.
Powell, H. A., 160.
Power, William, 67.
Praslin, Caesar Gabriel de Choiseul, Duke of, 23.
Preus, J. A. O., 200.
"Projector, A", 148, 153, 154, 155.

Raleigh, Sir Walter, 147.
Redfield, W. C., 176.
Reed, D. A., 193.
Reford, R. Wilson, 174, 246.
Reid, Hon. J. D., 235.
Richardson, John, 262.
Rinfret, Hon. Fernand, 203.
Ripon, Earl, 41.
Ritter, Alfred H., 139, 273.
Robb, Hon. James, A., 271.
Robert, J. B., 350, 351.
Robert, W. H., 351.
Romilly, Captain Samuel, 260.
Roosevelt, Franklin D., 249.
Root, Elihu, 45, 313.
Root, Lieut. William, 292, 293.
Rorke, L. V., 342.
Ross, Hon. W. B., 310.
Ross, W. G., 173.
Ruskin, John, 251.
Russell, Jonathan, 31.
Russell, J. A., 213.

Sabin, L. S., 170.
Sallust, 17.
Sandwell, Bernard K., 241, 244.
Saunders, W. L., 176.
Schenck, Robert C., 42.
Sclanders, F. Maclure, 163.
Scott, Sir Walter, 51.
Seneca, 85.
Shakespeare, 251.
Shanley, Walter, 327.
Shelburne, Earl of, 26.
Sifton, Sir Clifford, 212.
Smith, Alfred E., 215.
Smith, Alfred Holland, 60.
Smyth, Sir J. Carmichael, 280.
Soulanges, Louise Elizabeth Joybert de, 350.
Soulanges, Pierre Jacques, Marie de Joybert, Chevalier de, 350.
Spencer, Herbert, 355.
Stevenson, Alexander, 265.
Stewart, Hon. Charles, 208, 211.
Stewart, Major-General John, 212.
Stimson, Henry L., 313.
Story, Hon. Sidney, 161.
Sumner, George, 173.
Sweezey, R. O., 351.
Switzerland, President of, 42.

Taft, William H., 313.
Talon, Jean, 63.
Tanner, Hon. C. E., 235.
Taschereau, Hon. L. A., 204, 209, 233, 244, 331.
Taylor, President Zachary, 39.
Thompson, David, 141.

Thompson, Dr. T. Kennard, 177.
Thomson, Lesslie R., 248, 339, 366, 382, 383, 387.
Thornton, Sir Edward, 42.
Tiarks, Dr., 33.
Timon of Athens, 365.
Tombs, Laurence C., 331.
Townsend, Hon. Charles E., 156, 194.
Treadwell, Charles P., 327.
Tupper, Dr., 43.
Turgeon, Hon. Adelard, 212.
Twiss, Captain William, 257.
Tyler, President John, 35.

Vancouver, Captain George, 36.
Vaudreuil, Philippe de Rigaud, Marquis de, 350.
Viets, R. B., 213.
von Holst, H., 363.
Wadsworth, J. W., 192.
Walsh, Hon. Thomas J., 244, 245.
Ward, Captain Eber, 293.
Washington, George, 150, 251, 289, 393.
Weeks, Aaron, 292, 293.
Weeks, John W., 313.
White, Arthur V., 165, 214.
Williams, Frank M., 169, 179.
Williams, George H., 42.
Williams, G. S., 181.
Wilson, R. M., 203.
Wisner, George W., 156.
Wolfe, James, 21.
Wooten, W. P., 180.
Wright, Benjamin, 266.
Wrong, G., 213.

Young, A. J., 170.
Young, Hon. John, 139, 373.

SUBJECT INDEX

(See also *Contents*, pages 5 to 7)

Acadia: (see also Nova Scotia) Given up by France, 19; limits of 20.
Accommodation, The: First Canadian steamship, 64.
Act of Union, 1840: 32.
Africa: Developed and potential water power in, 334.
Akron Chamber of Commerce: Attitude of to project, 196.
Alabama Claims: Britain's anxiety to settle, 41, 42.
Alaska: Sold by Russia to U.S.A., 41.
Albany Chamber of Commerce: Attitude of to project, 198.
Alberta, Province of: Part of Great Lakes tributary area, 76; advantages to of Vancouver-Panama route, 326.
Alcoa Power Company: 349.
Algoma Steel Corporation: 171.
"All-American" Ship Canal project: Necessity urged for, 247; detailed particulars of, 329-331; 375.
Allan Gilmour & Company: Builders of fast vessels, 67.
Allan Line: Early history of, 64.
Alps: 87.
Aluminum Company of America: 158.
Amazon, River: Internationalization of, 90; comparison of with St. Lawrence Ship Channel, 139; 374; 375; 378.
America, North: Developed and potential water power in, 334.
America, South: Developed and potential water power in, 334.
American Farm Bureau Federation: Attitude of to project, 176.
American Manufacturers' Association: Attitude of to project, 176.
American Steamship Owners' Association: Attitude of to project, 200.
Amity, Commerce and Navigation, 1794, Treaty of: 29-31; annulled by war of 1812, 30.
Amsterdam Canal: Comparison with new Welland Canal, 273.
Appalachian Mountains: Western boundary of British Provinces, 24.
Arthur the Great: Built at Quebec, 67.
Ashburton-Webster Treaty, 1842: 32-34; most contentious ever signed, 32; Oregon boundary left unsettled by, 36; 48; 159.
Asia: Developed and potential water power in, 334.
Assouan Dam: British expenditure on, 192.

Atchison, Topeka and Santa Fe Railway: 71, 72.
Atlantic Coast Line Railroad: 71.
Atlantic Deep Waterways Association: Attitude of to project, 198.
Atlantic Ocean: Canal to connect Pacific with, 89; distance from to Father Point, 137; and St. Lawrence Ship Channel, 140.
Atlantic and North-West Railway: Acquired by Canadian Pacific, 59.
Atlantic and St. Lawrence Railway: Leased to Grand Trunk, 57.
Austria: and international navigation of waterways, 93.

Babylon: 87.
Baltimore: Distance from to Liverpool, 97.
Baltimore and Ohio Railroad: Extension of, 70; 71, 72.
Barge Canal Survey Commission: 301.
Barge Canal Terminal Commission: 301.
Barnhart Island: and Ashburton-Webster Treaty, 1842, 34.
Beauharnois Canal: (see also Soulanges Canal) 257; detailed particulars of, 263-265.
Beauharnois Light, Heat and Power Company: Details of project, 349-353.
Beauharnois Power Corporation: 351.
Belgium: Industrial characteristics of, 81, 82.
Bessemer and Lake Erie Railroad: 72.
Black River Canal: Canadian navigation rights in, 358.
Black Rock Canal: Detailed particulars of, 305.
Blessing of the Bay: Launch of, 73.
Bois Blanc Island: and Ashburton-Webster Treaty, 1842, 34.
Border Cities Chamber of Commerce: Attitude of to project, 196.
Boston: Shipbuilding at, 74; distance from to Liverpool, 97.
Boston Chamber of Commerce: Attitude of to project, 186, 198.
Boundary Treaty, 1925: First to be signed direct, 48.
Boundary Waters Treaty, 1909: 45-47; 103; 359; 361; definition of boundary waters, 46; and diversion, 46, 47; and International Joint Commission, 156, 157.
Bowen Lakes to the Hudson "All-American" Ship Canal: 330.
Bowmanville Chamber of Commerce: Attitude of to project, 196.
Brantford Chamber of Commerce: Attitude of to project, 196.
British Columbia: Enters Confederation, 41, 58; advantages to of Vancouver-Panama route, 326.
Brockville Board of Trade: Attitude of to project, 177.
Bronx Board of Trade: Attitude of to project, 198.
Brooklyn Chamber of Commerce: Attitude of to project, 198.
Bruce Mines Board of Trade: Attitude of to project, 196.

Brunelle: Fastest wooden sailing vessel, 67.
Buffalo: Phenomenal growth of, 78, 299; attitude of to project, 205; distance from to New York via Barge Canal, 324.
Buffalo Chamber of Commerce: Attitude of to project, 198.
Buffalo Corn Exchange: Attitude of to project, 198.
Buffalo Lumber Exchange: Attitude of to project, 198.
Buoyancy: Difference of in salt and fresh water, 108.

Calgary: Attitude of to project, 172.
California: Total installed h.p. capacity in, 335.
Canada, Province of: Ceded by France to Britain, 22, 23; Imperial Constitution of, 24; enters Confederation, 41.
Canada Steamship Lines: Construction of Kingston elevator, 273; 372; 377.
Canadian Deep Waterways and Power Association: Formation of, 163; and agitation to proceed with project, 166, 170, 172, 176-178, 184, 196.
Canadian Manufacturers' Association: Attitude of to project, 175, 196.
Canadian National Railways: (see Railways, *Canada*).
Canadian Navigators' Federation: Attitude of to project, 225.
Canadian Northern Railway: Second trans-continental system, 59; Government comes to assistance of, 60; Government takes over, 61; compensation, 61; Canadian National Railways formed, 61.
Canadian Pacific Railway: Gave length to Canada, 55; completion of, 59; acquires branch lines, 59; co-ordination of rail and water services, 82; and modern liners to Montreal, 138; national importance of, 203; and connections west and south with Fort William and Port Arthur, 259; *Truth's* forecast of failure of, 370; purpose of, 382.
Canadian Pacific Railway Syndicate: Takes over partly constructed railway to Pacific, 58.
Canals (*Canada*): Depth of, 14, 101; U.S. navigation rights in, 39, 44, 46, 357; deepening of, 56; navigation on, 101; early development of, 252-258; extent and dimensions of to-day, 258, 259.
Canals (*U.S.A.*): British navigation rights in, 44, 46, 358; navigation on, 101; early development of, 287-289; present extent and dimensions of, 289-307.
Cape Breton Island: Retained by France, 19; ceded to Britain, 22, 23.
Carillon Canal: Detailed particulars of, 277.
Carillon Rapids: 275.
Cascades Rapids: 253; 257; 258; 264; and Beauharnois project, 349.
Cayuga-Seneca Canal: (see New York State Barge Canal).
Cedar Rapids: 253; 264; and Beauharnois project, 349.
Central Electric Stations in Canada: 165.

Central Pacific Railroad: Opening of, 70.
Chambly Canal: Detailed particulars of, 281, 282; U.S. navigation rights in, 357.
Chambly Rapids: 281.
Champlain Canal: (see New York State Barge Canal).
Champlain, Lake: and Royal Proclamation, 1763, 24; Canadian navigation rights in connecting canals, 358.
Chaudière Falls: 275.
Chesapeake Bay: Railways terminating upon, 71.
Chesapeake River: Railway connections with, 71.
Chesapeake and Ohio Railway: 71, 72.
Chicago: Railway connections with Atlantic Ocean, 71; railway connections between spring wheat and corn belt states, 71; phenomenal growth of, 77; distance from to St. Lawrence River, 100; distance from to Montreal, 259; distance from to New Orleans via Lakes-to-the-Gulf-Deep-Waterway, 326, 331.
Chicago Association of Commerce: Attitude of to project, 196.
Chicago Board of Trade: Attitude of to project, 196.
Chicago, Burlington and Quincey Railroad: 71, 72.
Chicago Clearing House Association: Attitude of to project, 196.
Chicago, Milwaukee, St. Paul and Pacific Railroad: 71, 72.
Chicago and North Western Railway: 71.
Chicago River: Reversal of flow of, 310; as an alternative route to Europe, 324, 325.
Chicago, Rock Island and Pacific Railway: 71, 72.
Chicago Sanitary and Ship Canal: 210; 235; cost and purpose of, 310; detailed particulars of, 311-319, 359; bearing on Great Lakes and St. Lawrence navigation, 311; population served by, 312; Canada protects her interests, 316, 318; lake level reductions, 317; expenditure on remedial works, 318; memorial to President Hoover, 319, 320; as an alternative route to Europe, 324-326; freedom of navigation on, 359; compensation to Canada for diversion, 359.
Chicago and Rock Island Railway: Extension of, 70.
Churchill: Distance from to Winnipeg, 322, 331; distance from to Liverpool, 322; expenditure at, 323.
Chute à Blondeau Rapids: 275.
City Club of New York: Attitude of to project, 198.
Cleveland: Phenomenal growth of, 78, 82.
Cleveland Chamber of Commerce: Attitude of to project, 196.
"Clinton's Big Ditch:" (see New York State Barge Canal).

Coal: Railways identified with transportation of, 72; saving of, 162, 163, 175-177, 182, 187.
Collingwood Chamber of Commerce: Attitude of to project, 196.
Collingwood Shipbuilding Company: Builders of many fine ships, 69.
Columbia: Captain Robert Gray's ship, 35.
Columbia River: and Oregon Boundary Treaty, 1846, 36; comparison with St. Lawrence Ship Channel, 139; navigation rights in, 360.
Columbia and Kootenay Railway: Acquired by Canadian Pacific, 59.
Committee on Commerce: 39.
Committee on Development of Waterways and Co-ordination of Rail and Waterway Service (U.S.A.): Attitude of to project, 208.
Communication: and Post Office, 56; and motor cars, 56; and newspapers, 56; and radio, 56; Great Lakes, 75, 76.
Company of the Proprietors of the Lachine Canal: 260-262.
Congress of Vienna, 1815: Waterways prior to and after, 86; and freedom of navigation on inland waterways, 91, 92.
Connecticut River: and Treaty of Paris, 1783, 29.
Convention of Commerce, 1818: and Oregon Boundary Treaty, 1846, 35.
Corn Laws: Repeal of in Britain, 38.
Cornwall: Distance from to Kingston and Tibbetts Point, 99.
Cornwall Board of Trade: Attitude of to project, 196.
Cornwall Canal: Detailed particulars of, 266-268; U.S. navigation rights in, 357.
Cost: International Joint Commission's estimates, 104, 180, 181, 184, 191, 192: Joint Engineering Board's estimates—Thousand Islands section, 113; International Rapids section, 118; Lake St. Francis section, 123; Soulanges section, 129; Lachine section, 135; general summary, 136, 137; Sir Adam Beck's estimate, 163; T. Kennard Thompson's scheme, 177; Great Lakes-St. Lawrence Tidewater Association's scheme, 181; New York and Ontario Power Company's scheme, 181; Hydro-Electric Power Commission of Ontario's schemes, 201; Super Power Corporation of Buffalo's scheme, 205, 206, 215; St. Lawrence Commission (U.S.A.) schemes, 217, 218; Joint Engineering Board's Appendices, 222; U.S.A. share of, 224, 228; National Advisory Committee's analysis of, 227, 228; Professor Lesslie Thomson's estimates, 248, 339; Georgian Bay Canal scheme, 327-329; Beauharnois project, 350-353; the new project, 368, 386-388.
Coteau du Lac: Canal constructed at, 257, 258, 264.
Coteau Rapids: 253, 264; and Beauharnois project, 349.
Credit Valley Railway: Acquired by Canadian Pacific, 59.
Cunard Line: Formation of, 63; and modern liners to Montreal, 138.

Danube, River: 87; canal connection with Rhine, 88; internationalization of, 90; improvement of, 94, 374, 378.
Dee, River: 378.
Delaware, Lackawanna and Western Railroad: 71, 72.
Delaware River Ship Channel: Comparison with St. Lawrence Ship Channel, 139.
Delaware and Hudson Company: 72.
Demarcation of International Boundary, 1908, Treaty of: Terms, 45; 48.
Denver: Phenomenal growth of, 78.
Denver Civic and Commercial Association: Attitude of to project, 196.
Department of Marine and Fisheries: Assumes control of St. Lawrence Ship Channel, 145.
Department of Public Works: Assumes control of St. Lawrence Ship Channel, 145; handed over to Department of Marine and Fisheries, 145.
Department of Railways and Canals: 62; continuation of International Joint Commission's investigations, 105, 106.
Des Moines Chamber of Commerce: Attitude of to project, 196.
Desplaines River: Improvement of, 325.
Detroit: Phenomenal growth of, 78, 82.
Detroit Board of Commerce: Attitude of to project, 196.
Detroit River: Freedom of Navigation in, 34.
Detroit Transportation Association: Attitude of to project, 196.
Dominico: and Royal Proclamation, 1763, 24.
Dominion Marine Association: Attitude of to project, 196.
Duke-Price Power Company: 347-349.
Duluth: Phenomenal growth of, 78; distance from to Kingston, 100; distance from to Montreal, 259.
Duluth Board of Trade: Attitude of to project, 196.
Duluth, Missabe and Northern Railway: 73.
Duluth and Iron Range Railroad: 73.
Dunnville Board of Trade: Attitude of to project, 196.
"Dutch Award, The:" and Treaty of Ghent, 1814, 32-34.

Eastern Ontario Municipal Power Union: Attitude of to project, 196.
Eliza Ward: 292.
Elizabeth, Pa.: Launch of *Monongahela Farmer* at, 75.
England: (see Great Britain).
Erie Canal: (see New York State Barge Canal).
Erie, Lake: and international boundary, 14, 99; railways connecting with Atlantic, 71.

Erie Railroad: 71.
Euphrates, River: 87.
Europe: Bid for supremacy in New World, 18; and freedom of navigation on inland waterways, 90; what the Mediterranean is to, 162; developed and potential water power in, 334.
Euxine, The: 87, 88.

Farmers' Union of Nebraska: Attitude of to project, 196.
Farran Point Canal: Detailed particulars of, 267, 268: U.S. navigation rights in, 357.
Farran Point Rapids: 253.
Father Point: Distance from to Lake Ontario, 99; distance from to Atlantic Ocean, 137; distance from to Quebec, 137; distance from to Montreal, 139.
Faucille Rapids: Canal constructed at, 257.
Federal Power Commission of America: 205.
Fisheries: U.S. given rights in Canada, 39, 41; Britain given reciprocal rights, 39; and Treaty of Washington, 1871, 42, 43; Lubuc grounds ceded to Britain, 47.
Five Nations: (see also Six Nations) Sovereignty over, 19; freedom to trade, 20.
Flint, River: and Treaty of Paris, 1783, 29.
Florida, Treaty of: 35.
Florida, East: Government of under Royal Proclamation, 1763, 24, 25.
Florida, West: Government of under Royal Proclamation, 1763, 24; area of, 25.
Fort William: Distance from to Montreal, 259; and Canadian Pacific and Canadian National Railways connections west and south, 259.
Fort William Board of Trade: Attitude of to project, 171, 196.
Fort William City Council: Attitude of to project, 171.
Fraser's River: and Oregon Boundary Treaty, 1846, 36.
French River: and Georgian Bay Canal, 327, 329.
Frontenac, The: Commences weekly service on Lake Ontario, 64.
Frontier Corporation (U.S.A.): and development permit, 215.
Fuca, Straits of: and Oregon Boundary Treaty, 1846, 37.
Fundy, Bay of: and Treaty of Paris, 1783, 29; 30.

Galena and Chicago Railway: Construction of, 70.
Galop Canal: Detailed particulars of, 267, 268; U.S. navigation rights in, 357.
Galop Rapids: 253, 267-269.

Galt Board of Trade: Attitude of to project, 196.
Galveston: Distance from to Liverpool, 97.
Ganges, River: 378.
Gaspé Bay: and Treaty of Utrecht, 1713, 20.
Gatineau Power Company: 348.
Gazette, The (Montreal): Attitude of to project, 212, 221, 249, 250.
Georgian Bay Canal: Agitation for, 166; Shipping Federation of Canada and, 174, 185; detailed particulars of, 327-329; comparison with St. Lawrence and Erie Canal routes, 332, 365; 378; 393.
Georgian Bay and Lake Erie Railway: Absorbed by Grand Trunk, 58.
Germany: and world trade, 81, 384; and international navigation of waterways, 93.
Ghent, Treaty of, 1814: 31, 32; and Nova Scotia and Maine boundary, 33; 35; 48.
Globe, The (Toronto): Attitude of to project, 202, 209, 222.
Goderich Board of Trade: Attitude of to project, 196.
Gore, The: Reaches Lake Huron via Welland Canal, 65.
Governor Sullivan: Plies between Boston and Lowell, 288.
Grand Manan Channel: and Passamaquoddy Bay Boundary Treaty, 1910, 47.
Grand Portage: and Ashburton-Webster Treaty, 1842, 32.
Grand Rapids Association of Commerce: Attitude of to project, 196.
Grand Trunk Railway: Acquires branch lines, 57, 58; direct communication with U.S.A. established, 58; submits proposal for line from North Bay to Pacific, 59; National Trans-Continental started, 59; Royal Commission appointed, 60; Government takes over, 61; compensation, 61; Canadian National Railways formed, 61.
Grand Trunk Pacific Railway: Construction begun, 59; Government comes to assistance of, 60; Government takes over, 61.
Great Britain: Industrial development of, 80-82; "mistress of the seas," 89; abandonment of sovereignty, 89; freedom of the seas, 90.
Great Lakes: An international highway, 13; depth of connecting canals, 14, 100; international boundary, 14, 29, 99; French sphere, 19; international character of, 49; freedom of navigation in, 39; main highway to interior, 64; shipbuilding on, 65, 68, 69; growth of railway facilities to, 73; tributary areas (Canada and U.S.A.), 75-81; rail and water routes, 81, 82; length of, 96, area of, 99, 372; fall at mean stages, 100; expenditure on St. Mary's River, 101; navigation on, 101; commerce of, 101, 102; types of vessels on, 102; and St. Lawrence Ship Channel, 140; St. Lawrence and Great Lakes canal system, 259; railway connections west and south, 259; effect of Chi-

cago diversion on, 311, 359, 360; harbor dues on, 360; restricted navigation between, 371; freight carried on, 372.
Great Lakes Harbors Association: Attitude of to project, 223.
Great Lakes-St. Lawrence Tidewater Association: 163; and agitation to proceed with river improvement, 166, 177, 181, 200; alternative scheme of, 181; members visit Ontario and Quebec, 182.
Great Northern Railway: 71, 72.
"Great Ship:" Launch of, 74.
Great Western and Midland Railway: Taken over by Grand Trunk, 58.
Grenada: Government of under Royal Proclamation, 1763, 24.
Grenadines: Government of under Royal Proclamation, 1763, 24.
Grenville Canal: 277, 278.
Grenville Rapids: 275.
Grosse Point Channel: 304.
Gulf of Georgia: and Treaty of Demarcation of Interantional Boundary, 1908, 45.
Gulf of Mexico: Spain's sphere, 19; Britain's sphere, 22, 24; and Royal Proclamation, 1763, 25; railway connections with, 72; as alternative water route to Europe, 324, 325.

Halifax: Distance from to Liverpool, 97.
Hamburg: 381.
Hamilton: Attitude of to project, 184.
Hamilton Board of Trade: Attitude of to project, 196.
Hamilton Harbor Commission: Attitude of to project, 196.
Hamilton and North Western Railway: Acquired by Grand Trunk, 58.
Hannibal and St. Joseph Railway: First railway to the Missouri, 70.
Holland: a maritime nation, 81.
Houston Ship Channel: Comparison with St. Lawrence Ship Channel, 139; comparison with new Welland Canal, 273.
Hudson Bay: Given up by France, 19, 22; 24.
Hudson Bay Route: and western grain, 56, 172; detailed particulars of, 322, 323, 331; expenditure on, 323.
Hudson River: Canadian navigation rights in, 358.
Hudson River Railroad: Placed in operation, 70.
Hudson Ship Canal Company: and construction of an "All-American" route, 193.
Hudson Valley Federated Chamber of Commerce: Attitude of to project, 198.
Hudson's Bay Company: 25; Canada acquires North-West Territories from, 41; use of Hudson Bay by, 322, 323, 331; navigation rights in Columbia River, 360.

Huron, Lake; and international boundary, 14, 99; explored by Champlain, 96.
Hydro-Electric Power Commission of Ontario: Recommendations of, 114; and conservation of power for Canada, 158, 206; and possibilities of power development, 163, 164, 183; attitude of to project, 196; alternative schemes presented by, 201; conference with New York State Water Power Commission, 213-215; and purchase of power from Quebec, 339; description of, 342-346.

Ice: "Frazil," "anchor" and "slush," 111.
Illinois Central Railroad: Construction of, 70, 72.
Illinois Manufacturers' Association: Attitude of to project, 197.
Illinois River: (see Lakes-to-the-Gulf-Deep-Waterway).
Illinois and Michigan Canal: (see Chicago Sanitary and Ship Canal).
Illinois and Mississippi Canal: (see Lakes-to-the-Gulf-Deep-Waterway).
Imperial Bank of Canada: Attitude of to project, 239, 240.
Indiana Manufacturers' Association: Attitude of to project, 197.
Indiana Public Service Commission: Attitude of to project, 197.
Indiana State Chamber of Commerce: Attitude of to project, 197.
Indianapolis Chamber of Commerce: Attitude of to project, 197.
Institute of American Meat Packers: Attitude of to project, 197.
Inter-colonial Railway: Commencement of, 58; purpose of, 382.
Inter-Departmental Committee (Canada): Appointment of, 213.
International Board: Suggested appointment of, 121, 192, 224, 228.
International Court of Arbitration at the Hague: 365.
International Court of Justice at the Hague: 365.
International Joint Commission: Creation of, 46, 156; and diversion, 47; and investigation of St. Lawrence River, 103-106, 162-178, 180, 181, 184, 189-192, 194; alternative schemes presented by, 114, 115; and Boundary Waters Treaty, 1909, 156, 157; increasing public interest in, 158; and power rights to private corporations, 159, 160, 216; status of, 160, 168; and League of Nations, 168; T. Kennard Thompson's scheme, 177; Great Lakes-St. Lawrence Tidewater Association's scheme, 181; New York and Ontario Power Company's scheme, 181; recommendations of to remain in abeyance, 195.
International Mercantile Marine: 75.
International Rapids Section: Extent of and description, 113; improvement of 113-123; Hydro-Electric Power Commission of Ontario and International Joint Commission's recommendations, 114, 115; international board to control, 121; cost, 122, 123, 339; Canada and U.S.A. share in power, 158.

International Waterways Commission: and Treaty of Demarcation of International Boundary, 1908, 45; gives place to International Joint Commission, 46, 156; origin of, 156.
Iroquois River: (see St. Lawrence River).

Jay's Treaty: (see Treaty of Amity, Commerce and Navigation, 1794).
Joint Engineering Board: Appointment of, 106, 210; general recommendations of, 106-112; Thousand Islands section, 112, 113; International Rapids section, 113-123; best form of development for Canada, 120, 216, *222*; and international board of control, 121; and cost, 122, 123; Lake St. Francis section, 123; Soulanges section, 124-129; Lachine section, 129-135; general summary of recommendations, 135-137; submits Appendices, *222*; and Chicago diversion, 317.
Joint New England Commission of Foreign and Domestic Commerce: Attitude of to project, 198.
Junction Canal: *268*.

Kansas City: Railway extensions to, *72*.
Kansas City Chamber of Commerce: Attitude of to project, 197.
Keweenaw Waterway: Detailed particulars of, 306, 307.
Kennebec River: and Treaty of Utrecht, 1713, 20: launch of *Virginia* at, 73.
Kiel Canal: Comparison with new Welland Canal, *273*; comparison with Sault Ste. Marie Canal, *296*.
Kingston: Distance from to Cornwall and St. Regis, 99; erection of Canada Steamship Lines elevator at, *273*.
Kingston Board of Trade: Attitude of to project, 196.

Lachine Canal: Original plans for, 64, 254, 255; detailed particulars of, 259-263, *277*; U.S. navigation rights in, 357.
Lachine Rapids: *253*, 254.
Lachine Section: Extent of and description, 129, 130; International Joint Commission's recommendations, 130, 131; Joint Engineering Board's recommendations, 131-135; cost, 135, *339*.
Lake of the Woods: and Treaty of Paris, 1783, *29*, 32; and Ashburton-Webster Treaty, 1842, 34; and Convention of Commerce, 1818, 35; and Treaty of Demarcation of International Boundary, 1908, 45.
Lake St. Francis Section: Extent of, description, improvement of and cost, 123.
Lake Simcoe-Georgian Bay Branch of Trent Canal: *284-286*.
Lake Superior Paper Company: 171.

Lakes-to-the-Gulf-Deep-Waterway: 310, 311, 319, 320; as an alternative route to Europe, 324-326, 331, 365; freedom of navigation in, 359.
League of Nations: and International Joint Commission, 168.
Lehigh Valley Railroad: 71, 72.
Lemoyne: Dimensions of, 372, 377.
Liverpool: Distance to from North American ports, 97; distance to from Sault Ste. Marie, 170, 171; distance to from Winnipeg by St. Lawrence route, 322; distance to from Winnipeg via Hudson Bay route, 322; distance to from Vancouver via Panama Canal, 326, 332.
Long Sault Development Company: 158.
Long Sault Rapids: 253, 265, 277.
Louisiana: Launch of, 75.
Louisiana, Territory of: Area of, 19, 25; and Oregon Boundary Treaty, 1846, 35; Treaty of, 35.
Louisville and Nashville Railroad: 72.
Lowell Falls Canal: 288.
Lubuc: Fishing grounds ceded to Britain, 47.

Madrid, Treaty of, 1750: 23.
Magnet: Sinking of, 265.
Maine Commission of Foreign and Domestic Commerce: Attitude of to project, 198.
Maine, State of: and Treaty of Utrecht, 1713, 20; and Treaty of Ghent, 1814, 32, 33.
Manchester Ship Canal; Comparison with new Welland Canal, 273; comparison with Sault Ste. Marie Canal, 296; cost of, 296.
Manitoba Free Press: Attitude of to project, 221.
Manitoba, Province of: Creation of, 41; part of Great Lakes tributary area, 76.
Manitoba South Western Railway: Acquired by Canadian Pacific, 59.
Marietta, Ohio: Launch of *St. Clair* at, 75.
"Marriage of the Waters," 298.
Maryland, State of: Canal construction in, 289.
Massachusetts Bay: Early shipbuilding at, 74.
Massena Water Power Company: 159.
Mayflower: 74.
Medford, Mass.: Launch of *Blessing of the Bay* at, 73.
Merchants' Association of New York: Attitude of to project, 198.
Michigan Federation of Women's Clubs: Attitude of to project, 197.
Michigan, Lake: (see also Chicago Sanitary and Ship Canal) Free navigation to Britain granted, 43, 44, 46, 359; of unique advantage to U.S.A., 79; popuation and industry around, 82; wholly American, 99.

Middlesex Canal: 288, 289.
Milk River: 361.
Milwaukee: Phenomenal growth of, 78.
Milwaukee Association of Commerce: Attitude of to project, 197.
Milwaukee Civic Association: Attitude of to project, 197.
Minneapolis: Phenomenal growth of, 78.
Minneapolis Civic and Commerce Association: Attitude of to project, 197.
Minnesota Federation of Farm Bureaux: Attitude of to project, 197.
Minnesota Federation of Farmers' Clubs: Attitude of to project, 197.
Minnesota Livestock Breeders' Association: Attitude of to project, 197.
Minnesota Railroad and Warehouse Commission: Attitude of to project, 197.
Minnesota, State of: Attitude of to project, 181.
Miquelon, Island of: Retained by France, 23.
Mississippi, River: (see also Chicago Sanitary and Ship Canal) Spain's sphere, 19, 20; freedom of navigation on, 23, 29, 30, 358; and West Florida, 25; railways operating to eastern bank of, 71; growth of railway facilities to, 73; comparison with St. Lawrence Ship Channel, 139; as an alternative route to Europe, 324-326; 378.
Mississippi valley: Railway connections with Pacific coast, 72.
Mississippi Valley Association: Attitude of to project, 197.
Missouri-Kansas-Texas Lines: 72.
Missouri Pacific Railroad: 72.
Mobile, River: River and port ceded to Britain, 23; comparison with St. Lawrence Ship Channel, 139.
Mobile and Ohio Railroad: 72.
Molson Line: (see St. Lawrence Steamship Company).
Monongahela Farmer: Launch of, 75.
Montana Livestock Commission: Attitude of to project, 197.
Montana, State of: Advantages to of Vancouver-Panama route, 326.
Montreal: Cartier's arrival at, 96; advantageous situation of, 97; distance from to Liverpool, 97; distance from to Lake Ontario, 100; distance from to Quebec, 100; fall from Lake Ontario to, 100; fall from to sea, 100; size of ships coming to, 137, 138: distance from to Father Point, 139: attitude of to project, 166, 182-184, 186, 203, 205, 207, 212, 233, 234; distance from to Fort William and Port Arthur, 259; distance from to Duluth, 259; distance from to Kingston via Ottawa and Rideau Rivers Canals and via St. Lawrence, 275; effect of Chicago diversion at, 317; distance from to French River village, 328.

Montreal Board of Trade: Attitude of to project, 173, 174, 185, 198, 240-243.
Montreal Chamber of Commerce: Attitude of to project, 198, 236; and Georgian Bay Canal scheme, 329.
Montreal Daily Star, The: Attitude of to project, 221.
Montreal Harbor Commission: and construction of St. Lawrence Ship Channel, 142-144; work handed over to Department of Public Works, 145; and attitude of to project, 173, 198, 234, 238, 239.
Montreal Light, Heat and Power Consolidated: 348.
Montreal and Lake Maskinongé Railway: Acquired by Canadian Pacific, 59.
Montreal and Ottawa Railway: Acquired by Canadian Pacific, 59.
Murray Canal: Detailed particulars of, 282, 283; U.S. navigation rights in, 357.

National Advisory Committee (*Canada*): Appointment of, 211; Joint Engineering Board's Appendices submitted to, 222; Report of, 226-234.
National Trans-Continental Railway: Construction begun, 59.
National Waterways Association of Canada: Attitude of to project, 196.
Navigation Law: Britain suspends on St. Lawrence, 37.
Nebraska Farmers' Elevator Association: Attitude of to project, 197.
Nelson, Port of: Expenditure on, 323.
New Amsterdam: Launch of *Onrust* at, 73.
New Brunswick: Part of Acadia, 20; part of Nova Scotia, 31; and Maine Boundary, 32; enters Confederation, 41; shipbuilding at, 67, 68.
New Brunswick Railway: Acquired by Canadian Pacific, 59.
New England: No definite boundary, 30; and Treaty of Amity, Commerce and Navigation, 1794, 31; railway connections with, 71.
New England Power Company: 184.
Newfoundland: Given up by France, 19.
New Orleans: French sphere, 19; retained by France, 23, 30; distance from to Liverpool, 97; and Mississippi Ship Channel, 139; distance from to Chicago via Lakes-to-the-Gulf-Deep-Waterway, 326, 331.
New York: Shipbuilding at, 74; distance from to Liverpool, 97; shipping at in 1916; becames commercial emporium of U.S.A., 299; distance from to Buffalo via Barge Canal, 324; distance from to Lake Ontario via Barge Canal, 324.
New York Central Railroad: 71.
New York-Lake Erie Railroad: Placed in operation, 70.
New York Produce Exchange: Attitude of to project, 198.

New York State Barge Canal: New York State's investment in, 169, 195; distance from Sault Ste. Marie to Liverpool via, 170, 171; inadequacy of, 193; advertising of, 195; Ottawa River connections with, 282; expenditure on, 296; early history of, 296, 297; first trip from Buffalo to New York via, 297, 298; "marriage of the waters," 298; enlargement of, 298-300; abolition of tolls, 298; operating profit in 1883, 298; "Nine Million Law," 299; "One Hundred and One Million Dollar Barge Canal Act," 299; names of canals constituting, 300; expenditure on terminals, 301; tonnage through, 301, 302; as an Atlantic route to Europe, 324, 365; and "All-American" Ship Canal, 330, 331; comparison with St. Lawrence and Georgian Bay routes, 332; Canadian navigation rights in, 358.
New York State Chamber of Commerce: Attitude of to project, 198.
New York, State of: Attitude of to project, 166, 168, 169, 182, 183, 185, 186, 188, 189, 192, 193, 197, 200, 205, 223; and investment in Barge Canal, 169; Governor Roosevelt's scheme, 249; and "All-American" Ship Canal project, 330; total installed h.p. capacity in, 335.
New York State Water Power Commission: Conference with Hydro-Electric Power Commission of Ontario, 213-215; scheme of development of, 215.
New York State Waterways Association: Attitude of to project, 223.
New York and Ontario Power Company: 160; alternative scheme of, 181.
Niagara Falls, 253.
Niagara Falls Convention, 1929: 48, 49.
Niagara River: Diversion of, 48; rapids and shoals in, 305; potential power in, 342; cost of power in, 343.
Nile, River: 87, 378.
"Nine Million Law:" 299.
Nipissing, Lake; and Royal Proclamation, 1763, 24; and Georgian Bay Canal, 327-329.
Norfolk and Western Railway: 71, 72.
North Bay Board of Trade: and Georgian Bay Canal, 329.
North Minnesota Development Association: Attitude of to project, 197.
North Shore, Nova Scotia Railway: Acquired by Canadian Pacific, 59.
North Shore Power Company: 347.
North Shore, Quebec, Montreal, Ottawa and Occidental Railway: Acquired by Canadian Pacific, 59.
North-West Company: Early construction of Sault Ste. Marie Canal by, 274.
Northern Inland Lock Navigation Company: 287, 288, 297.
Northern Pacific Railway: 71, 72.

Northern Quebec Power Company: 349.
Northern Railway: Acquired by Grand Trunk, 58.
North-West Territories: Acquired by Canada from Hudson's Bay Co., 41.
Nova Scotia: (see also Acadia) Part of Acadia, 20; ceded to Britain; 22; renounced by France, 23; and Treaty of Paris, 1783, 29; no fixed boundary, 30; boundary fixed, 31, 33; becomes partly Province of New Brunswick, 31; enters Confederation, 41; shipbuilding at, 67, 68.

Oceania: Developed and potential water power in, 334.
Ohio Farmer's National Grain Association; Attitude of to project, 197.
Ohio River: and Royal Proclamation, 1763, 24.
Omaha: Phenomenal growth of, 78.
Omaha Chamber of Commerce: Attitude of to project, 197.
Omaha Grain Exchange: Attitude of to project, 197.
"One Hundred and One Million Dollar Barge Canal Act:" 299.
Onrust: First vessel to be built with decks, 73.
Ontario Associated Boards of Trade and Chambers of Commerce; Attitude of to project, 222, 223.
Ontario Hydro-Electric Power Commission: (see Hydro-Electric Power Commission of Ontario).
Ontario, Lake: and international boundary, 14, 99; distance from to Father Point, 99; distance from to Montreal, 100; and deep water navigation, 101; effect of Chicago diversion on, 317; distance from to New York via Barge Canal, 324; dimensions of, 372.
Ontario Municipal Electrical Association: Attitude of to project, 225.
Ontario Power Commission: (see Hydro-Electric Power Commission of Ontario).
Ontario, Province of: Northern boundary of settled, 20; and part of Great Lakes tributary area, 76; attitude of to project, 166, 205, 212, 233; entertains members of Great Lakes-St. Lawrence Tidewater Association, 182; policy of towards power development, 206; dependence on U.S.A. for coal, 207; shortage of power in, 339; power resources of, 342-347.
Ontario and Quebec Railway: Acquired by Canadian Pacific, 59.
Oregon Boundary Treaty, 1846: 34-37; U.S. territorial claims, 34, 35; Great Britain's territorial claims, 36; Spain's territorial claims, 36; settlement of terms of, 37; Vancouver Island boundary, 44; 360.
Ores: Railways identified with transport of, 72, 73.
Oswego Canal: (see New York State Barge Canal).
Ottawa Board of Trade: Alternative project of, 172.
Ottawa Canal: 275; U.S. navigation rights in, 357.
Ottawa Forwarding Company: 276.

Ottawa River: Explored by Champlain, 96; navigability of, 275-277; connection with New York, 282; and Georgian Bay Canal, 327, 328.
Ottawa River Navigation Company, 278.
Ottawa and Rideau Rivers Canals: Detailed particulars of, 275-279.

Pacific Ocean: Railway connections with Mississippi valley, 72; canal to connect Atlantic with, 89.
Panama Canal: Comparison with new Welland Canal, 273; comparison with Sault Ste. Marie Canal, 295, 296; cost of 296, 373; comparison with Lakes-to-the-Gulf-Deep-Waterway, 311; restricted navigation in, 372; prejudice against construction of, 373.
Paraguay, River: Internationalization of, 90.
Paris, Peace of, 1814: 91.
Paris, Treaty of, 1763: 20-24; Royal Proclamation under, 24, 25, 30.
Paris, Treaty of, 1783: 27-29; and Treaty of Amity, Commerce and Navigation, 1794, 30; and Treaty of Ghent, 1814, 31, 32; and Ashburton-Webster Treaty, 1842, 33; U.S. fishing privileges under, 41; 48.
Passamaquoddy Bay: Boundary in, 45.
Passamaquoddy Bay, Boundary Treaty, 1910: 47, 48.
Peace Conference (Paris): and international navigation of waterways, 93.
Peace River: Agricultural area of, 368.
Pennsylvania Railroad: Extension of, 70-72.
Pennsylvania, State of: Railway connections in anthracite region, 72; and canal construction, 289.
Philadelphia: Distance from to Liverpool, 97; gives place to New York as commercial emporium, 299.
Philadelphia Board of Trade; Attitude of to project, 198.
Philadelphia Bourse: Attitude of to project, 198.
Philadelphia Commercial Exchange: Attitude of to project, 198.
Pigeon River: and Ashburton-Webster Treaty, 1842, 34; and Treaty of Demarcation of International Boundary, 1908, 45.
Pittsburgh: Launch of *Louisiana* at, 75.
Pittsburgh and Lake Erie Railroad: 72.
Point Cardinal Rapids: 253, 267.
Pointe aux Iroquois Rapids: 253, 267, 268.
Poland: and international navigation of waterways, 93.
Polson Shipbuilding Company: Builders of many fine ships, 68.
Popes Folly Island: Ceded to U.S.A., 47.
Popham Colony: Early U.S. shipbuilding by, 73.
Porcupine, River: Free navigation to Great Britain given, 43, 44, 360.

Port Arthur: Distance from to Kingston, 100; distance from to Montreal, 259; and Canadian Pacific and Canadian National Railways connections west and south, 259.
Port Arthur Board of Trade: Attitude of to project, 171, 196.
Port Arthur City Council: Attitude of to project, 171.
Portland: Distance from to Liverpool, 97; Columbia and Willamette Rivers Ship Channels to, 139.
Portland Chamber of Commerce: Attitude of to project, 198.
Potomac River: and railway connections between eastern cotton states, 71.
Power: 13-15, 98, 103, 104; Joint Engineering Board's general recommendations, 109-112; summary of recommendations, 135-137; estimated power, 158, 161, 187; and rights to private corporations, 159, 160, 216; possibilities of, 163-165, 174-178, 182, 183, 188, 201, 202, 218; ownership of water power rights, 236; questions to Supreme Court of Canada, 237; judgment, 243, 244; Professor Lesslie Thomson's recommendations, 248; and Chicago Sanitary and Ship Canal, 311-313; discovery of, 334; world's supply of developed and potential, 334; total production in U.S.A., 335; available and developed h.p. in Canada, 336-349; capital invested in in Canada, 339; shortage of, 339; Beauharnois project, 349-353; Canada's and U.S. share of, 380.
Prescott: Welland Canal terminal at, 272.
Price Bros. and Company: 349.
Prince Edward Island: Retained by France, 19; 20.
Proprietors of the Locks and Canals on Merrimack River: 288.
Providence Chamber of Commerce: Attitude of to project, 198.

Quebec: Surrender of, 20, 21; Government of under Royal Proclamation, 1763, 24, 25; shipbuilding at, 65, 66; temporary decline and revival of shipbuilding at, 67; fast sailing vessels built at, 67; shipbuilding industry ceases at, 68; Champlain discovers, 96; distance from to Liverpool, 97; distance from to Montreal, 100; size of ships coming to, 137; distance from to Father Point, 137.
Quebec Act: Supersedes Royal Proclamation, 1763, 24.
Quebec Power Company: 347.
Quebec, Province of: Attitude of to project, 164, 166, 188, 198, 204, 208-210, 212, 233, 234, 331; and sale of power to Hydro-Electric Power Commission of Ontario, 339; shortage of power in, 339; power resources of, 347-353.

Railways (*Canada*): Extent of, 56; development of, 57-59, 60, 62; effect of the war on, 60; Royal Commission appointed, 60; Government takes over, 61; Canadian National Railways formed, 61; capitaliza-

tion of in 1927, 62; changes in last 30 years, 76; "development in advance of requirements," 76, 77; Government support for Canadian National Railways, 239; connections with Fort William and Port Arthur west and south, 259; freight traffic in 1928, 385.

Railways (*U.S.A.*): Aggregate length and development of, 69; extensions of, 70; Atlantic and Pacific Oceans connected, 70; feeders, 70; systems connecting north Atlantic seaboard with Lake Erie and Chicago, 71; systems operating to eastern bank of Mississippi, 71; New England connections, 71; Chesapeake Bay connections, 71; connections between eastern cotton states and Potomac River or Chesapeake, 71; connections between spring wheat and corn belt states, 71; extensions into Kansas City, 72; connections between Gulf of Mexico and St. Louis or Chicago, 72; connections between Pacific coast and Mississippi valley, 72; Pennsylvania anthracite region connections, 72; bituminous coal connections, 72; special commercial functions of, 72; growth of systems around Great Lakes and Mississippi River, 73; capitalization of, 73; inadequate facilities in tributary area, 78-80, 188; rail and water routes, 81, 82; abolition of tolls, 298.

Rapide Plat Canal: Detailed particulars of, 267, 268; U.S. navigation rights in, 357.

Rapide Plat Rapids: 253.

Reading Company: 72.

Reciprocity Treaty, 1854: 37-40; Canadian farmers and U.S. tariffs, 37, 38, 40; Britain suspends Navigation Law, 37; Merritt's resolutions introduced, 39; Committee on Commerce Bill introduced, 39; terms drafted, 39; terminated by U.S., 40; responsible for beginning of Canadian national life, 40; fishing rights conferred on U.S., 41.

Regina: and Hudson Bay route, 322.

Rhine, River: Canal connections with Danube, 88; improvements to, 94; 378.

Rhode Island Commission of Foreign and Domestic Commerce: Attitude of to project, 198.

Richelieu River Navigation System: 280-282.

Rideau Canal: 275, 277; detailed particulars of, 278-280; U.S. navigation rights in, 357.

Rio de la Plata, River: Internationalization of, 90.

"River of Canada:" 96.

Rivers and Harbors Committee (U.S.A.): and "All-American" Ship Canal, 330, 331.

Rochester: Increased population of, 299.

Rocky Mountains: and Oregon Treaty, 1846, 34-37; and Demarcation Treaty, 1908, 45.

Royal Proclamation, 1763: 24, 25, 30.
Royal William: First steamer to cross Atlantic, 63.
Russian America: 41; and Oregon Boundary Treaty, 1846, 34, 36; U.S. purchases Alaska, 41.

St. Andrews Canal: U.S. navigation rights in, 357.
St. Andrews Steam Forwarding Company: 276.
St. Anne Lock: 275-277.
St. Catharines Chamber of Commerce: Attitude of to project, 196.
St. Clair: Launch of, 75.
St. Clair Flats Canal: British navigation rights in, 44; detailed particulars of, 303, 304; Grosse Pointe Channel, 304; Canadian navigation rights in, 358.
St. Clair, Lake: Free navigation given to Britain, 34; shoals at, 253, 303, 304.
St. Clair Tunnel: Completion of, 58.
St. Croix, River: and Treaty of Utrecht, 1713, 20; and Treaty of Paris, 1783, 29; and Treaty of Amity, Commerce and Navigation, 1794, 30, 31; and Ashburton-Webster Treaty, 1842, 33, 34; and Treaty of Demarcation of International Boundary, 1908, 45.
St. Jean, Isle: (see Prince Edward Island).
St. John, Lake: Power resources of, 349.
St. John, River: and Royal Proclamation of, 1763, 24; free navigation of, 34.
St. Lawrence Commission (U.S.A.): Appointment of, 211; Report of, 216-218; U.S. adopts recommendations of, 219; Joint Engineering Board's Appendices submitted to, 222.
St. Lawrence, Gulf of: and Treaty of Utrecht, 1713, 19, 20; and Treaty of Paris, 1763, 23.
St. Lawrence, River: Extent of, 13, 96, 99; free navigation of to U.S., 14, 29, 34, 37, 38-40, 43, 44, 46, 49, 137, 360, 379; developed by Canada, 14; international character of, 14, 49; islands and coasts in ceded, 23; and Royal Proclamation, 1763, 24; and Treaty of Paris, 1783, 29; Great Britain and France claim land between and Bay of of Fundy, 30; and Treaty of Ghent, 1814, 31, 32; and Treaty of Demarcation of International Boundary, 1908, 45; diversion of, 46, 47, 158, 159, 210, 311, 317, 359; early navigation on, 64; main highway to interior, 64; early freight charges on, 64; Cartier's discovery of "River of Canada," 96; space it would occupy in Europe, Africa, U.S.A., South America, 97; importance of as trade route, 97; water power development in, 98, 158, 163-165, 174, 175; distance from Lake

Ontario to Father Point, 99; distance from Kingston or Tibbetts Point to Cornwall and St. Regis, 99; distance from Duluth, Port Arthur, Chicago to, 100; distance from Montreal to Quebec, 100; fall from Lake Ontario to Montreal, 100; fall from Montreal to sea, 100; navigation on, 101; International Joint Commission's investigation, 103-105, 164, 167-178, 180-184, 187, 189, 190-192; continuation of investigation by Department of Railways and Canals (*Canada*), 105, 106; Joint Engineering Board's investigation, 106-137, 210, 216; St. Lawrence Ship Channel, 137-145; improvement project of 1832, 148-155; Great Britain invited by U.S.A. to join in formation of international commission of investigation, 155; representatives appointed by Canada and U.S.A., 155, 156; International Waterways Commission appointed, 156; succeeded by International Joint Commission, 156; Great Britain invited to negotiate agreement for improvement of navigation, 156, 157, 194, 195, 233, 244; rights to private corporations, 159, 160, 216; an American Mediterranean, 162, 246; capital expenditure by Canada and U.S.A., 166; distance from Sault Ste. Marie to Liverpool, 170, 171; recommendations of International Joint Commission to remain in abeyance, 195; schemes of Hydro-Electric Power Commission, 201; Super Power Corporation of Buffalo's scheme, 205, 206; Ontario's policy towards power development, 206; conference at Ottawa, 208; and public opinion, 211; St. Lawrence Commission (*U.S.A.*) appointed, 211; National Advisory Committee (*Canada*) appointed, 211, 212; Inter-Departmental Committee (*Canada*) appointed, 213; New York State Water Power Commission's scheme, 215; Report of St. Lawrence Commission, 216-219; Canada invited by U.S.A. to proceed with project, 219, 220; Joint Engineering Board submits Appendices, 222; Canadian Government's attitude to project, 226; Report of National Advisory Committee, 226-234; appointment of Special Senate Committee (*Canada*), 235, 236; question of ownership of water power rights, 236; questions referred to Supreme Court of Canada, 237; judgment, 243, 244; Professor Lesslie Thomson's schemes, 248; Governor Roosevelt's scheme, 249; effect of Chicago diversion on, 311; distance between Winnipeg and Liverpool by St. Lawrence route, 322; and Georgian Bay Canal, 327, 328; distance from Montreal to French River village, 328; comparison with Erie Canal and Georgian Bay route, 332; Beauharnois project, 349-353; marine insurance rates on, 375.

St. Lawrence River Power Company: 114, 158.

St. Lawrence Ship Channel: Deepening of, 56; general description of, 137, 138; comparison with other ship channels, 139; agitation for

improvement of, 139; great engineering project, 139; no maintenance charges, 140; vital link in water communication, 140; improvement negotiations and construction, 140-145, 184; prejudice against deepening, 373.
St. Lawrence Steamship Company: Formation of, 64.
St. Lawrence and Ottawa Railway: Acquired by Canadian Pacific, 59.
St. Louis: Railway connections with Gulf of Mexico, 72.
St. Louis: Launch of, 75.
St. Louis-San Francisco Railway: 72.
St. Mary's Rapids: 253, 290.
St. Mary's River: and Treaty of Paris, 1783, 29; expenditure upon, 101, 296; improvement of, 295; traffic through, 296; 361.
St. Ours Lock and Dam: Detailed particulars of, 281; U.S. navigation rights in, 357.
St. Paul: Phenomenal growth of, 78.
St. Paul: Launch of, 75.
St. Paul Traffic Association: Attitude of to project, 197.
St. Peters Canal: U.S. navigation rights in, 357.
St. Pierre, Island of: Retained by France, 23.
St. Regis: Distance from to Kingston and Tibbetts Point, 99.
St. Vincent: and Royal Proclamation, 1763, 24.
Saint John: Distance from to Liverpool, 97.
Sabine-Neches Canal: Comparison with new Welland Canal, 273.
Salem: Launch of "Great Ship" at, 74.
San Juan Water Boundary: and Treaty of Washington, 1871, 42.
Saskatchewan, Province of: Part of Great Lakes tributary area, 76.
Saskatoon Star-Phoenix, The: Attitude of to project, 240.
Sault St. Louis Rapids: (see Lachine Rapids).
Sault Ste. Marie Canal (*Canadian*): Distance from to Liverpool, 170, 171; tonnage carried in 1916, 171; detailed particulars of, 274; traffic through, 290; U.S. navigation rights in, 357.
Sault Ste. Marie Canal (*U.S.A.*): Early history of, 289-293; present day canal, 294-296; Federal Government stops construction of, 292, 293; comparison with Panama Canal, 295, 296; natural resources of surrounding territory, 295; comparison with Suez Canal, 296; expenditure on, 296; traffic through, 296; Canadian navigation rights in, 358.
Sault Ste. Marie Board of Trade: Attitude of to project, 171, 196.
Sault Ste. Marie City Council: Attitude of to project, 171.
Scugog Branch of Trent Canal: 284.
Seaboard Air Line Railway: 71.
Seneca Chief: First vessel to make through journey Buffalo to New York, 298.

Seven Years War: 21.
Shawinigan Water and Power Company: 347.
Shipping Federation of Canada: Attitude of to project, 173, 174, 198, 246; and Georgian Bay Canal, 174, 185.
Shipping and Shipbuilding (*Canada*): Early history of, 63-65; end of wooden and beginning of iron and steel, 68; future of, 68.
Shipping and Shipbuilding (*U.S.A.*): Early history of, 73; withdrawal of mail subsidies, 74, 75; inland shipbuilding, 75; steel ships, 75; at its zenith, 75.
Shooting Star: Built at Quebec, 67.
Six Nations: (see also Five Nations) Ceded by France to Britain, 25.
Smith and Driggs: and construction of Sault Ste. Marie (*U.S.A.*) Canal, 292.
Soulanges Canal: (see also Beauharnois Canal) Detailed particulars of, 263-265; U.S. navigation rights in, 357.
Soulanges Section: Extent of and description, 124, 125; installed capacities, 125; schemes for navigation alone, 127-129; cost of, 129, 339; and Beauharnois project, 349.
South Dakota Development Association: Attitude of to project, 197.
South Dakota Federation of Farm Bureaux: Attitude of to project, 197.
South Dakota Grain Dealers' Association: Attitude of to project, 197.
South Hadley Falls Canal: 288.
Southern Canada Power Company: 347, 349.
Southern Pacific Company: 72.
Southern Railway: 71, 72.
Spain: Claims to Oregon country, 36; her period of greatness, 81.
Split Rock Rapids: Canal construction at, 257, 258, 264; and Beauharnois project, 349.
Springfield Chamber of Commerce: Attitude of to project, 197.
Stikine, River: and free navigation to Britain, 43, 44, 360.
Sturgeon Bay and Lake Michigan Ship Canal: Detailed particulars of, 302, 303.
Sudbury and Sault Ste. Marie Railway: Acquired by Canadian Pacific, 59.
Suez Canal: Comparison with new Welland Canal, 273; comparison with Sault Ste. Marie Canal, 296; cost of, 296; comparison with Lakes-to-the-Gulf-Deep-Waterway, 311; restricted navigation in, 372.
Sulpicians, The: Early canal development by, 254, 255, 260.
Super Power Corporation of Buffalo: and scheme for St. Lawrence River development, 205, 206, 215.
Superior, Lake: 34; and international boundary, 14, 99; and Ashburton-Webster Treaty, 1842, 34; natural resources of surrounding territory, 295; and stormy weather navigation in, 306; dimensions of, 372.

Supreme Court of Canada: Questions addressed to, 237; judgment of, 243, 244.

Tadousac: Champlain plants flag of France at, 96.
Tay Branch of Rideau Canal: 278, 280.
Terre Haute Chamber of Commerce: Attitude of to project, 197.
Thames, River: 378.
Thousand Islands Section: Extent and description of, 112; improvement of, 113; cost, 113.
Thunder Bay Improvement Company: 272.
Tibbett's Point: Distance from to Cornwall and St. Regis, 99.
Tigris, River: 87.
Tobago: and Royal Proclamation, 1763, 24.
Toledo: Phenomenal growth of, 78.
Toledo Commerce Club: Attitude of to project, 197.
Toledo Produce Exchange: Attitude of to project, 197.
Toronto: Attitude of to project, 182-184.
Toronto Board of Trade: Attitude of to project, 196, 223.
Toronto Daily Star, The: Attitude of to project, 202, 224, 249.
Toronto, Grey and Bruce Railway: Acquired by Canadian Pacific, 59.
Toronto Harbor Commission: Attitude of to project, 196; and Georgian Bay Canal, 329.
Trade: World groups, 54; modern organization of, 54; development of, 54.
Transportation; a century ago, 52; to-day, 53; colossal part played by, 54, 56; cheapness of necessary, 55, 367; water routes, 55; Great Lakes and, 75, 76, 78-82; not identical in Canada and U.S., 229.
Treaties: Annulment of by war, 30, 41, 358.
Trent Canal: Detailed particulars of, 283-286; U.S. navigation rights in, 357.
Tributary Areas (*Canadian and U.S.A.*): 75-82.
Trou du Moulin: Canal construction at, 257, 258.
Trout Lake: and Georgian Bay Canal, 328.
Troy Chamber of Commerce: Attitude of to project, 198.
Truth: and Canadian Pacific Railway, 370.
Turners Falls Canal: 288.
Turtle Lake: and Georgian Bay Canal, 328.

Union Pacific Railroad: 70-72.
United States of America: Total installed h.p. capacity in, 335; total production of h.p. in, 335.

United States Army Engineers: and "All-American" Ship Canal project, 329.
United States Department of Commerce: Report on project, 218, 219.
United States Farmers' National Grain Dealers: Attitude of to project, 197.
Utrecht, Treaty of, 1713: 19, 20, 48.

Vancouver: Distance from to Liverpool via Panama Canal, 326, 332.
Vancouver Island: Differences over channel boundary, 44.
Vancouver-Panama Route: 326, 332.
Venice: and advantages to of access to sea, 81.
Victoria Bridge, Montreal: Completion of, 57, 58.
Virginia: Launch of, 73.
Virginia, State of: Canal construction in, 289.
Virginian Railway: 72.

War: Annulment of treaties, 30, 31, 41, 358; and effect of on project, 168, 175, 178.
War of the Spanish Succession: 19.
Washington, Treaty of, 1871: Importance of, 14; 40-44; questions to be settled by, 42; 48, 360.
Water Power Commission of the State of New York: Alternative schemes submitted to, 115.
Welland Canal: U.S. navigation rights in, 44, 200, 357; new canal, 56, 94, 101, 108, 191, 270, 271; and purely Canadian character of, 228: early history of, 269, 270; committee on elevator construction, 272; Prescott site, 272, 273; Kingston terminal, 273; comparison with other ship canals, 273; and "All-American" Ship Canal, 330; and restricted navigation, 371, 372; 377.
West Ontario Pacific Railway: Acquired by Canadian Pacific, 59.
Western Inland Lock Navigation Company: 287, 288, 297.
Western Maryland Railway: 72.
Western Ontario United Boards of Trade: Attitude of to project, 196.
Western Pacific Railroad: 72.
Westphalia, Treaty of, 1648: 23.
Wheeling and Lake Erie Railway: 72.
Whitehall Canal: (see New York State Barge Canal).
White Star Line: and modern liners to Montreal, 138.
Willamette, River: Comparison with St. Lawrence Ship Channel, 139.
William Cramp and Sons: Build *St. Louis* and *St. Paul*, 75.
Williamsburg Canals: 267-269; U.S. navigation rights in, 357.
Windsor Chamber of Commerce: Attitude of to project, 196.

Winnipeg: Attitude of to project, 172; and Hudson Bay Route, 322; distance from to Churchill, 322, 331; distance to Liverpool by St. Lawrence route, 322.
Winnipeg Board of Trade: Attitude of to project, 172.
Winnipeg to Manitou Railway: Acquired by Canadian Pacific, 59.
Wisconsin Railroad Commission: Attitude of to project, 197.

Yangtse, River: Comparison with St. Lawrence Ship Channel, 139.
Yukon, River: Free navigation given to Britain, 43, 44, 360.

AMERICA
SEPTENTRIO-
NALIS
CIRCULUS
New North Wales
Buttons
Bay
AMER
SEPTENTRION
NUEVA
GRANADA
NUEVA BISCAYA
GOLFO DE
MEXICO
MARE
MAR DEL
ZUR
LINEA ÆQU
1629
AMSTELODAMI,
Excudit Ioannes Ianßonius

ARCTICUS
FRETUM HUDSON
FRETUM DAVIS
META IN COGNITA
OCEANUS DEUCALE DONJUS
NOVA BRITANNIA
NOVA Canada
Novelle Discure
FRANCIA
Golphe de S. Louis
Golphe de
Terra
Arcadia
NOVUM BELGIUM
VIRGINIA
MARE VIRGINIUM
MAR DEL NORT
TROPICUS CANCRI
SANTA MARTHA
PARIA
MERIDIONALIS PARS
Parime lacus
300
310
320
330
340
350
50
40
30
20
10

NEWSPAPER REVIEWS

"The St. Lawrence Waterway Project"
by George Washington Stephens

February 20th, 1930.—*La Presse*—
"Un ouvrage qui est destiné a etre consulté avec la plus grande attention."

February 20th, 1930.—*The Montreal Herald*—
"Mr. George Washington Stephens, after months of research and study, has completed a book entitled 'The St. Lawrence Waterway Project' copiously illustrated and undoubtedly fulfills its purpose to place essential and authoritative information within reach of Canadians and citizens of the United States whose interests are mutually involved."

February 21st, 1930.—Mr. Georges Pelletier, *Le Devoir*—
"Les données groupées, si clairement dans son ouvrage aiderone a se renseigner ceux que veulent se faire la dessus une opinion motivée."

February 22nd, 1930.—*Montreal Gazette*—
"This book is one to be reckoned with in all future discussions of the question."

February 22nd, 1930.—*La Patrie*—
"Dans le volume de Mr. Stephens est en effet rassemblée toute la documentation utile pour se former sur ce grand projet un jugement eclairé."

February 22nd, 1930.—
"The whole of the first edition of 'The St. Lawrence Waterway Project' was sold on the first day of its publication."

February 22nd, 1930.—
"This magnificent work is a complete summary of the Waterway scheme. We deem it a great privilege to be able to recommend this volume to the reading public of Canada."—Sydney Foster Brown.

February 22nd, 1930.—
"Mr. Stephens, in this very able and scholarly volume, gives us a remarkable insight into the varying phases of this momentous question."—Henry Morgan & Company, Limited.

February 22nd, 1930.—
"If a book come from the heart it will continue to reach other hearts."—Burton's Limited.

February 22nd, 1930.—Albert R. Carman in the *Montreal Daily Star*—
"Those of us who have been interested in the St. Lawrence Waterway Project have felt all along the crippling lack of a comprehensive and authoritative book of reference. Now we have one; George Washington Stephens has come to our rescue. I cannot close without remarking how deftly and appropriately Mr. Stephens has decorated this usually dry subject with quotations from the Classics. He has thus given to a discussion of stagnant canals and whirling power houses the light touch of literary elegance."—Albert R. Carman.

February 28th, 1930.—*Weekly News,* Montreal—
"Every Canadian who takes a real interest in the development and welfare of his country should read this book."

March 4th, 1930.—*Power,* New York City—
"Contains an absorbing chapter on the International Aspect of Arterial Waterways."

March 6th, 1930.—*Financial Post*—
"Major Stephens has made a most comprehensive analysis of the whole Waterways Project in a manner interesting to read and valuable for reference."

March 15th, 1930.—*Evening Citizen,* Ottawa—
"The author covers the whole subject and every sub-division of it."

March 15th, 1930.—*The Globe,* Toronto—
"Those who wish to inform themselves on the St. Lawrence Seaway enterprise—and this should include everyone interested in important public affairs, owe an obligation to Mr. George Washington Stephens for producing the most comprehensive survey of the problem yet put into print."

March 18th, 1930.—*London Advertiser,* London, Ont.—
"No other volume contains so much information on all phases of the question."

Published by LOUIS CARRIER & COMPANY, Limited
1154 Beaver Hall Hill - MONTREAL
and LOUIS CARRIER & ALAN ISLES, Inc.
33 East Tenth Street - NEW YORK CITY